HOME MECHANIC'S WORKSHOP COMPANION

ANDREW JACKSON, JR.

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HOME MECHANIC'S WORKSHOP COMPANION

BY
ANDREW JACKSON, JR.

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INTRODUCTION

For a number of years past, the author has derived considerable pleasure and has spent a portion of his spare time profitably in a small workshop located in his home. He has been very much interested in following many hints and ideas that have appeared in the current issues of the mechanical periodicals, and has kept a notebook and made sketches of the many devices constructed that have proved useful about the home and shop.

The most practical and useful of the numerous suggestions tried have been grouped under chapter headings to make for logical presentation and easy reference, and the many devices illustrated and described cannot fail to be helpful and suggestive to men of mechanical bent.

The construction of a shop bench, and the items of tools and supplies that will be found useful in making light repairs to the home and its furnishings, are considered because it is believed that many men who are about to establish or amplify small workshops can obtain suggestions that may help them from the experience of the author, who is not a mechanic by trade, but just a self-trained

handy man who likes to use good tools in "pottering" around the house. Many light repairs have been made at a material saving that would otherwise have called for more expert, and needless to say more highly paid, mechanics than the writer. Any man or boy will find that a knowledge of the use of ordinary tools for working wood and metal will come in handy in many ways, and provide entertaining and profitable employment for time that is ordinarily wasted.

ANDREW JACKSON, Jr.

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HOME MECHANIC'S WORKSHOP COMPANION

CHAPTER I

THE HOME WORKSHOP AND ITS EQUIPMENT

Selection of Shop Space—Construction of Workbench—Simple Bench Furniture—Keeping Tools in Their Places—Tools and Equipment—Lighting the Workbench—Combined Sawhorse and Tool Carrier—Wood-working Tools—Metal-working Tools—Supplies for Home Workshop.

THE man who likes to work with tools is found in many different walks of life ; some have mechanical trades, and some are business and professional men. The workshop equipment naturally varies with the mechanical skill of the owner and the character of work he wishes to do. Some home mechanics, interested in model-making and experimental science, have very complete shops, with a lathe and other mechanical equipment. This treatise is not intended for a mechanical expert or a man carrying on experiments of an electrical and scientific nature. It is intended as a handy manual for the average man who desires to rig up a small shop where he can do odd jobs in constructing household appliances,

making needed light repairs to the home and its furnishings, and spend long evenings to advantage in building simple pieces of cabinet work.

Selection of Shop Space.—The important requirement is that the shop be situated in a clean, light, warm, and well ventilated place. If a suitable small building is available, such as a section of an automobile garage, as many handy men are also car owners, the problem is easily solved. If only light work is to be done, an attic room may be converted for shop purposes, but if heavier work is to be attempted, such as building substantial furniture or perhaps a small boat, then the shop should be in a more accessible place. The basement of the modern home is usually well suited for shop purposes, as it is dry and warm in the winter because of the furnace. The problem of lighting is easily met by the almost universal use of electricity in present-day homes, and there is always some corner convenient to an area where sufficient daylight is available. Large objects are more easily brought into or carried out of the cellar than the attic.

The point to be impressed on the average home mechanic is that much time is saved and work is more easily done when working conditions are good. The shop should have a good workbench, cabinets or chestsfor tools and supplies, and an adequate amount of such small hardware as is necessary to take care of the ordinary odd jobs. Tools should be of good quality, because such tools last a lifetime if given ordinary care, while cheaply made tools are never

satisfactory, and should not be purchased, because any money expended on them is practically wasted. One can do accurate work only with good tools. A dull saw or chisel that will not hold its edge is an abomination, and many men who really have mechanical ability are discouraged in their attempts

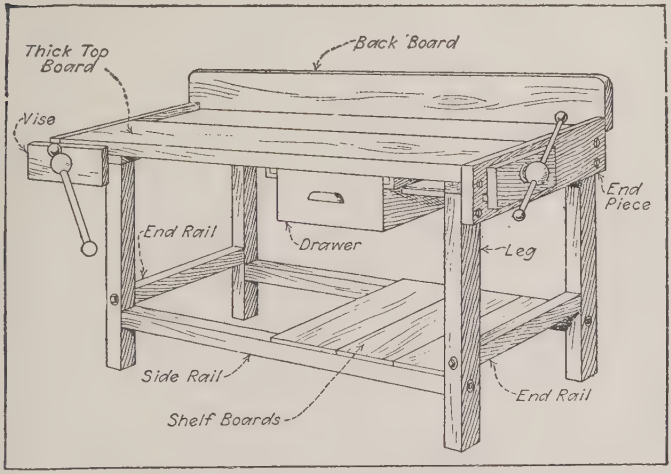

FIG. 1.—SIMPLE AND SUBSTANTIAL WORKBENCH FOR HOME WORKSHOP USE.

to do work by the handicap of improper tools. While a large variety of tools for both wood- and metal-working purposes are to be described, the selection naturally rests on the individual, who should purchase those that are needed and best adapted for the work in hand. The list of supplies is given only in a suggestive sense, as many of the materials mentioned can be purchased as required.

More tools will be needed if one intends to work both wood and metal than if wood alone is to be the medium for expressing one's mechanical ability.

The storage of tools is important. They should be kept clean and dry so they will not rust, and be stored away in such a way that cutting edges will not be damaged or the tools distorted. Saws should be hung in cabinets, planes kept in boxes or laid on their side in a special place where other tools will not come in contact with them. Drills and bits should be kept in drilled wood or metal blocks. Files should never be thrown promiscuously with other tools. Chisels ought to be kept as sets in racks or boxes and their cutting edges protected. The main thing is to have a place for everything and to keep everything in its place.

Construction of Workbench.—The most important item of workshop equipment and the real basis of the shop is the workbench. These vary in construction from roughly boarded packing-boxes and old tables to very complete and elaborate factory-made benches almost as complex as a kitchen cabinet. The bench shown at Fig. 1 is a substantial yet simple workbench that can be made by any handy man with tools at much less cost than the expense of purchasing one of as good quality ready-made. It is a handy size that has been used by the writer in his own small shop with excellent results. The drawer provides ample accommodation for small tools and supplies, the shelf beneath can be used for keeping more bulky objects off the

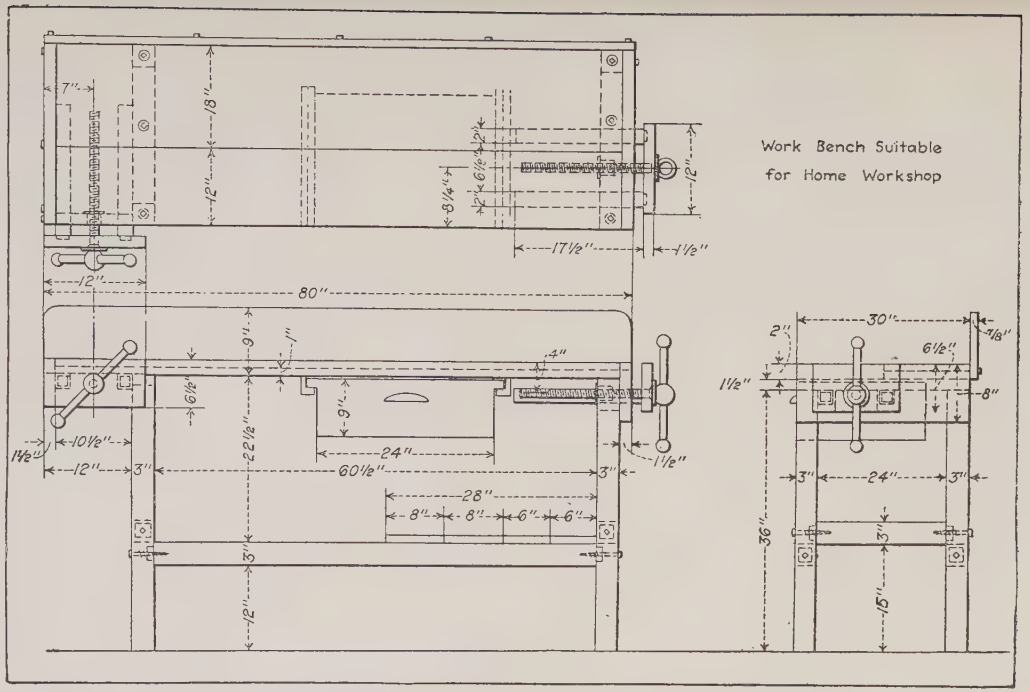

FIG. 2.—WORKING DRAWINGS GIVING CONSTRUCTION DIMENSIONS OF HOME WORKSHOP BENCH.

floor. While two vices are shown, the one at the end of the bench for handling short work can be replaced with a metal machinist's vice, and then the bench becomes suitable for both wood- and metal-working.

The working drawings at Fig. 2 give all the important dimensions, and details at Figs. 3 and 4 will further clarify the explanation. The over-all dimensions are 6′ 6″ long, 3′ 3½″ high, and 30″ wide. Either birch or maple may be employed, as both of these woods make a very good bench. Oak or ash legs and rails and ash planking will also be a very satisfactory combination. The necessary stock may be purchased from any lumber mill ready planed and cut to length, in which case considerable labour will be saved. The following is a list of material if dressed lumber is purchased:

Name of Part	Number Required	Size
Bench Legs	4	3″ × 3″ × 36″
End Rails	2	3″ × 3″ × 24″
Side Rails	2	3″ × 3″ × 62½″
Back Board	1	⅞″ × 9″ × 80″
Top Board (Front)	1	2″ × 12″ × 77″
Top Board (Centre)	1	⅞″ × 6″ × 77″
Top Board (Back)	1	⅞″ × 12″ × 77″
Crosspieces	2	1½″ × 3″ × 30″
Clamps for Vice	2	1½″ × 6½″ × 12″
Vice Clamp Guides	4	2″ × 2″ × 18″
Screw Blocks	2	3″ × 3″ × 6″
End Piece	2	1⅓″ × 8″ × 30″
Shelf Boards	2	⅞″ × 8″ × 30″
Shelf Boards	2	⅞″ × 6″ × 30″
Drawer Front	1	⅞″ × 9″ × 24″
Drawer Back	1	⅞″ × 9″ × 24″
Drawer Sides	2	⅞″ × 8″ × 22″

Name of Part	Number Required	Size
Drawer Bottom . . .	2	$\frac{7}{8}'' \times 6'' \times 24''$
Drawer Bottom . . .	2	$\frac{7}{8}'' \times 5'' \times 24''$
Cleats for Drawer Side .	2	$1'' \times 1'' \times 22''$
Slides for Drawer . .	2	$\frac{7}{8}'' \times 2\frac{1}{4}'' \times 24''$
Slides for Drawer . .	2	$1'' \times 1'' \times 24''$

Besides the wood pieces enumerated above, various items of hardware will be needed. These include one drawer handle, 2 doz. $\frac{3}{8}'' \times 5''$ lag screws, 2 doz. $\frac{3}{8}''$ iron washers, 3 doz. wood screws about $1\frac{1}{2}''$ long, 1 pint linseed oil, and 2 malleable iron vice screws complete with handle, collar bearing, and nut as shown at Fig. 5, this screw being about $1''$ or $1\frac{1}{4}''$ in diameter and $24''$ long. Wooden vice screws can be obtained, but these are not as satisfactory as the iron ones and not much cheaper. If the worker desires, he can obtain a very satisfactory carpenter's bench vice as shown at Fig. 5, this being purchased complete and ready for installation to the bench side or end.

Of the lumber specified, the material for the centre and back top boards, the back board, the shelves, and for making the drawer, need not be anything more than pine, as no great wear comes upon these parts. The bench top front board should be of maple or birch, also the vice clamp and bench end pieces. The legs may be of maple, birch, oak, or ash, the end rails and side rails of any of these woods. The wood should be clear grained, free from knots or checks or surface blemishes.

The first step is the construction of the lower frame. As the rails are held into the posts by

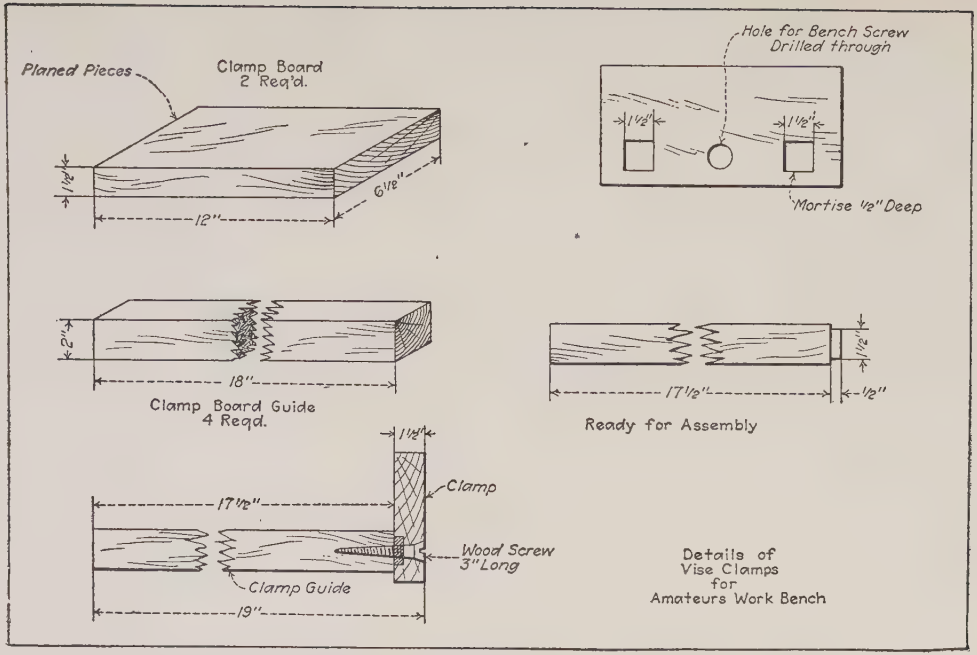

FIG. 3.—DETAILS OF VICE CLAMP DESIGN FOR HOME WORKSHOP BENCH.

mortise and tenon joints, reinforced by an iron lag screw as shown at Fig. 4, the first step is to cut the tenons on the ends of each rail, side or end, and the corresponding mortises in the bench legs. The tenons are 2″ square by 1″ deep, so the mortised-out places on the legs must be of corresponding size. The mortises for the side rails are cut 12½″ from the end that is to rest on the floor, those for the side rails are cut 15½″ from the end. When the mortise and tenon joints are made, the rails are assembled to the legs. A ⅜″ hole is drilled through each leg into the centre of the mortise, and a ¼″ hole into the tenon at each end of the rail about an inch in depth. The legs and rails are then fastened securely together by the 5″ × ⅜″ lag screws, the threads of the screw being covered literally with yellow soap to insure its screwing into the rail end easily. An iron washer is placed under each lag screw head to prevent its sinking into the wood. The crosspieces are fastened to the top of the legs by lag screws, the heads being countersunk, or wood screws may be used of about ¼″ shank and 4″ long. An alternative to countersinking the screw heads, if lag screws are used, is to drill holes in the bottom of the top boards to fit over them. The front top board is then fastened to the crosspieces by substantial screws, such as short lags, put in from the bottom, and the screw should not be over 2½″ long. The centre and back top board may be put in and held with screws from the top.

The next step is to cut the mortise and tenon

joints in the clamp board and clamp guide pieces and assemble as shown at Fig. 3. A hole is bored through for the bench screw as indicated. The tenons are set in glue and held securely by a countersunk head wood screw about 3″ long. The vice or bench screw block pieces are fastened to the bottom of the bench and a hole bored through, using that in the clamp board as a guide for the nut of the vice screw. The end board is provided with square holes to take the clamp guides or slides, and a round one providing clearance for the vice screw. It is then fastened to the legs by substantial countersunk head wood screws.

The back board is then fastened in place with wood screws. The installation of the shelf boards is a very simple matter, these being placed on top of the side rails and secured thereto with wood screws. The pieces comprising the drawer are assembled with nails or screws, the latter being preferred. The back and front pieces are fastened to the sides, all four pieces lining up at the top. This will leave the front and back of the drawer projecting down 1″ from the sides. When the drawer bottom boards are nailed on across the sides, this space is taken up, and the drawer becomes a box 24″ square by 9″ deep outside and 8″ deep inside. The 1″ square cleats are fastened along the top of the drawer sides with screws, and the drawer slides are attached to the top bench underside as shown at Fig. 4.

An alternative method of drawer support is shown

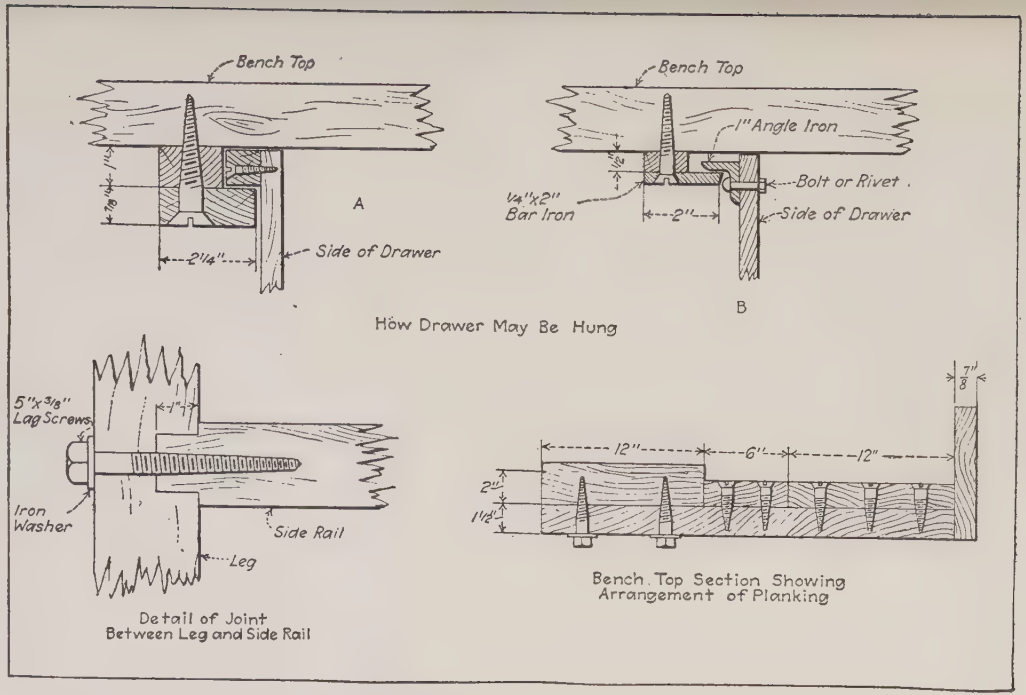

FIG. 4.—HOW DRAWER MAY BE HUNG, AND OTHER DETAILS OF WORKBENCH CONSTRUCTION.

at Fig 4, B. In this, the 1″ angle iron slides are bolted or riveted to the drawer side, and these work on metal guides composed of $\frac{1}{4}'' \times 2''$ iron bars of rectangular section screwed through wood spacer cleats $\frac{1}{2}'' \times 1''$ to the bench. After the bench is assembled, all the lag screws in the frame are tightened up. Then the bench is gone over with sand-

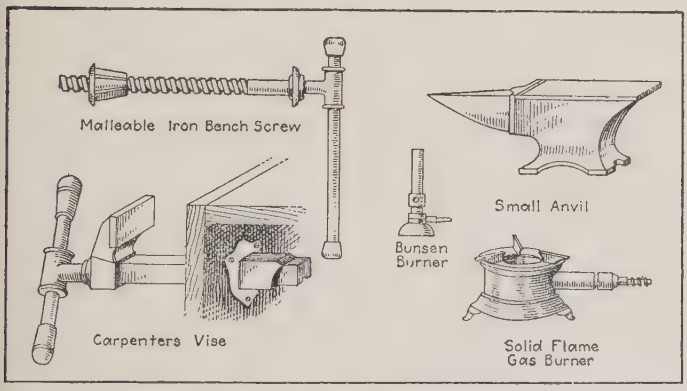

FIG. 5.—USEFUL ITEMS OF BENCH EQUIPMENT, SHOWING MALLEABLE IRON BENCH SCREW AND CARPENTER'S METAL VICE.

paper and smoothed, after which the smooth surfaces are given a couple of coats of linseed oil, which not only preserves the wood, but also gives it a good finish.

Simple Bench Furniture.—There is a certain amount of bench equipment, such as stops, etc., that can be purchased very cheaply. A simple stop that can be placed at the end of a bench, to hold the end of a board in place when planing it on the

flat side, is shown at Fig. 6, A. This is easily made of two pieces of hard wood, two iron washers, and two lag screws. The vertical piece may be adjusted up and down to compensate for the thickness of the piece, the horizontal piece serves as a clamping member. In moving the vertical piece, it is necessary to slack the lag screws out slightly to release the clamping pressure. This can also be used as a vice for holding small work.

The clamp or vice shown at Fig. 6, B, is easily made by any blacksmith, and it may be used either vertically by passing it through a hole in the bench top, or as a vice for holding work at the bench end by providing a suitable hole for the screw rod to pass through. The construction is so clearly shown that further description is unnecessary.

The simple fixture shown at Fig. 6, C, is of value when light wood pieces such as moulding are to be sawed, and by cutting saw slots at various angles in the stopboard at the end as a guide, it serves as a simple and effective mitre box. It is also handy in holding short pieces of wood, such as blocks, when these are to be planed. It is made of a piece of $\frac{7}{8}''$ board about 8″ wide × 14″ long, and two pieces as stops, one $\frac{7}{8}'' \times 2'' \times 8''$, the other the same width and length but only $\frac{1}{2}''$ thick. To use this fixture, it is merely placed on the bench and pushed against one of the stops, the work being rested against the other as shown. The object of having one stop shorter than the other is so that wood less than $\frac{7}{8}''$ thick can be planed by placing it against the

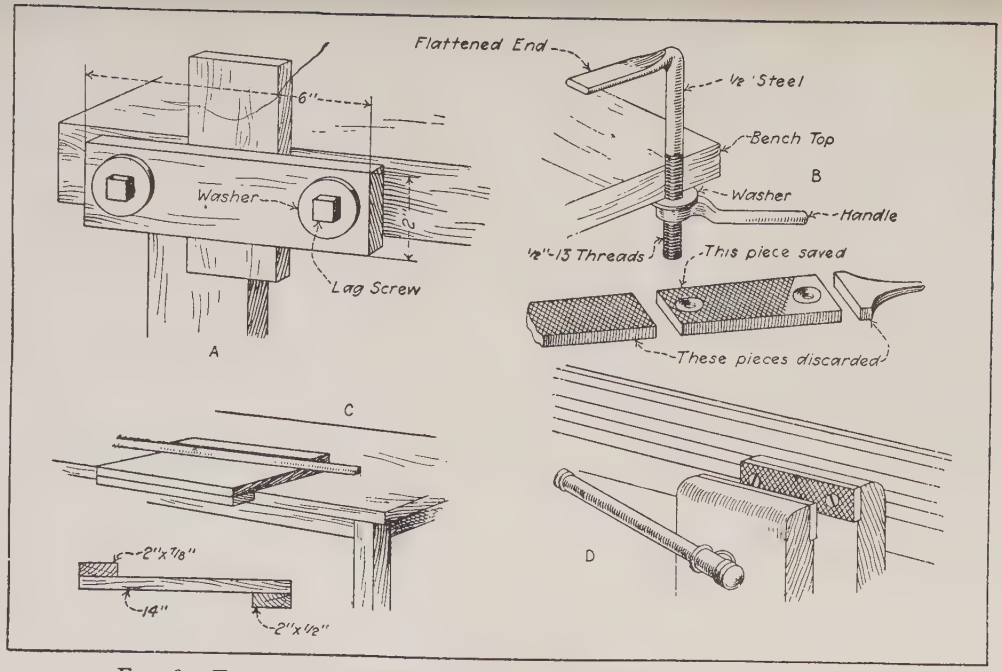

FIG. 6.—EASILY-MADE APPLIANCES FOR USE WITH HOME WORKSHOP BENCH.

thin stop piece instead of the thick one. The end pieces may be held by brads or screws.

A wood jaw vice can be converted to one that will hold metal pieces by a simple expedient as outlined at Fig. 6, D. Two old files are needed, either 12″ or 14″ long, of flat, rectangular section. The files are heated to a red heat and allowed to cool slowly in ashes or in the air. Holes are drilled as indicated, and countersunk in pieces cut from the files of sufficient length to fit the vice jaws. The vice jaws are cut back about half the thickness of the file, thus providing a ledge for the piece of file to rest against. The pieces are then fastened to the jaws with countersunk head screws. The file teeth provide a good grip on metal pieces held in the vice, and, as they are soft, they are not as brittle as they are in their hardened condition, and they are not apt to crumble away.

Keeping Tools in their Places.—A very satisfactory method of keeping tools out of the way when not in use, and yet having them accessible when needed, is shown at Fig. 7, A. This is a rotating tool-rack that may be easily constructed by the home mechanic and installed without trouble. While it is shown attached to the bench at the bottom of sketch, it may be supported by wall brackets at both ends and kept clear of the bench if desired. Round wooden or sheet steel discs are provided with a series of holes to receive various small tools. The rod may be of wood, such as an old broom-handle, or iron bar or pipe; a good way is to use pieces of

pipe as spacers between the discs, assembling the pipes and discs around a central steel rod member which has nuts top and bottom to hold pieces together.

The common methods of making tool-racks are shown at Fig. 7, B. In this the wall or back board of the bench is utilized as a support for wooden blocks used as spacers, while a lath serves as a closure member for the spaces left between the blocks to hold the tools. The method of using a leather belt or strap for the same purpose is also clearly outlined. Loops of various sizes are made by the irregular spacing of the retention screws.

Spring holders as outlined at C may be made by the handy man, these being held to the wall by a wood screw. In addition to the main clamping spring jaws, which will hold any ordinary handle, the small loops will hold various small tools without trouble, such as gimlets, bradawls, scissors, etc. A spring holder of this form is very useful for holding brooms, mops, rakes, and other long-handled household or garden tools if made heavier than would be required for less weighty tools.

A more pretentious rack for holding tools and small pieces in process is shown at Fig. 7, D, and this may be made of any desired size so it can be placed on the bench, or in the larger sizes, on the floor. The shelves are made of steel plates, and are supported by four bolts passing through them and having pipe spacers between them. A small rack suited for the bench can be assembled of plates or

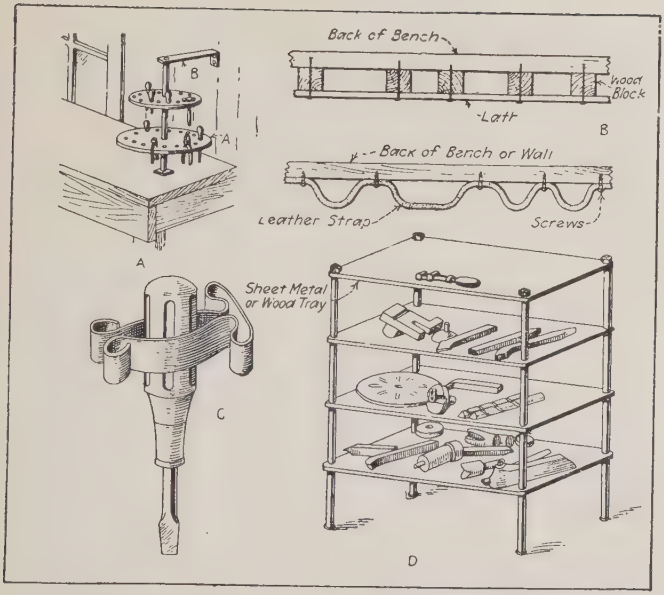

FIG. 7.—SUGGESTIONS FOR HAVING TOOLS ACCESSIBLE YET KEEPING THEM OUT OF THE WAY ON WORKBENCH.

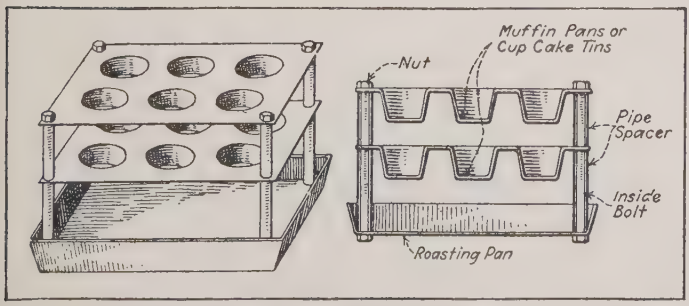

FIG. 8.—HOW ORDINARY TINWARE MAY BE USED AS CONTAINERS FOR SCREWS, NAILS, AND OTHER MATERIALS.

boards about 12″ × 24″, using $\frac{1}{4}$″ rods as bolts and $\frac{3}{8}$″ pipe spacers. A larger size for floor use could be made of $\frac{1}{2}$″ rods, $\frac{3}{4}$″ pipe spacers and steel plate 24″ × 30″ or built-up wood shelves of any desired size.

The small rack shown at Fig. 8 is made of muffin pans or cup cake tins in combination with a roasting pan, using bolts and pipe spacers to hold the assembly together. The depressions in the pan make ideal depositories for nails, tacks, small screws, nuts, and make it possible to keep the various sizes separated and easily accessible. The pans are spaced 4″ or 5″ apart, nuts at the top and bottom of the rods serving to clamp the entire assembly together. The rods need not be more than $\frac{3}{16}$″ cold rolled; the pipe spacers are the so-called $\frac{1}{8}$″ gas-pipe size, which have a bore of about $\frac{3}{16}$″. The materials to construct such a rack need not cost more than a shilling or two.

A very simple revolving rack is shown at Fig. 9, this also being composed of muffin tins of the round form that have six or seven cups. The method of assembling this is clearly outlined, and it is a very useful receptacle for small supplies. The single bolt or bearing is about a $\frac{3}{8}$″ rod; the pipe spacers need not be a tight fit. In fact, wood tubes could be used. The use of pipe makes it possible to use a floor or wall plate as a convenient base. The materials for a rack of this kind are also very inexpensive. The advantage of the rectangular rack shown at Fig. 8 is that it can be moved about on the bench. That at Fig. 9 can be placed at any point where it

will be out of the way. Its lack of mobility is made up for by the security obtained by not being able to tip it over and spill out the numerous and widely diversified contents.

Tools and Equipment.—In considering the various items of tools and equipment that can be purchased, the list is made more complete than the average home mechanic would be apt to need, yet it will not be sufficiently large for the hobbyist and mechanical experimenter. If much metal-work is to be done, a small anvil as shown at Fig. 5 will be a useful adjunct to the bench equipment. The solid flame gas burner is very useful for heating the glue-pot, soldering iron and other work of that nature. The Bunsen burner is also useful where an intensely hot but concentrated flame is desired.

A group of useful appliances for the wood-worker is given at Fig. 10. The wooden clamps are the form usually employed by carpenters and cabinet-makers for holding pieces in gluing, etc. The C-clamps in forged steel are used in metal-work, while the malleable iron clamps may be used either for wood or metal. The water-jacketed glue-pot is very good for the man who likes to mix his own glue, though the prepared glues that may be purchased in cans of various sizes usually answer the purpose of the amateur or home craftsman. The mitre box may be made by the workman himself. It is really a saw guide, and is used in cutting small wood pieces such as moulding for picture frames, etc. The shellac bottle is nothing more than a pint or quart milk

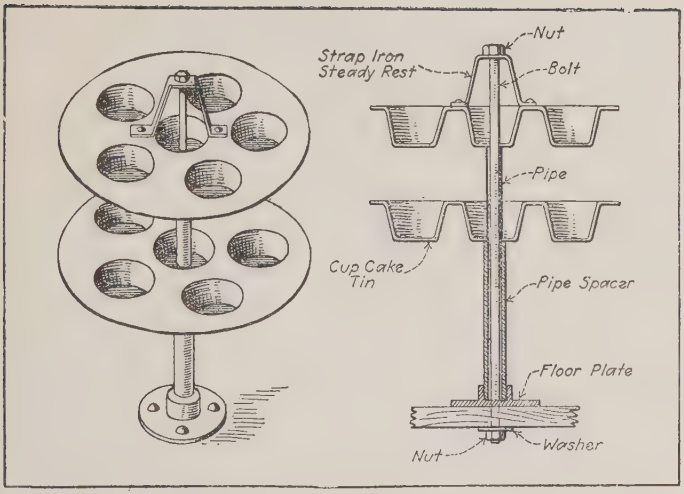

FIG. 9.—REVOLVING RACKS FOR SMALL HARDWARE MAY BE MADE EASILY OF MUFFIN TINS.

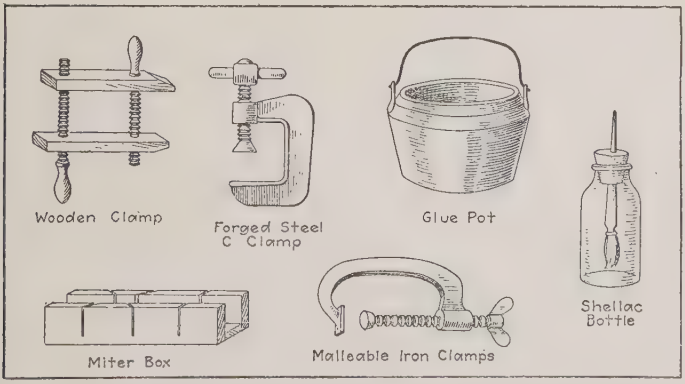

FIG. 10.—USEFUL WORKBENCH ACCESSORIES THAT CAN BE USED TO ADVANTAGE BY HOME MECHANICS.

bottle, provided with a wooden stopper to which a chisel-point brush is fastened to spread the shellac as shown.

Lighting the Workbench.—Where electricity is available, the electric light is an ideal method of illuminating the workbench. The method of supporting the light, which is adequately shaded, shown at Fig. 11 is a very good one, as the lamp can be moved from one end to the other of the workbench, and the lamp cord is kept clear of the bench. The cord is attached to wooden spools or small porcelain insulators with friction tape, these sliding freely on a piece of copper or steel wire stretched between two shelf brackets as indicated. These may be built up of wood pieces $1\frac{1}{2}''$ or $2''$ square, or may be purchased from any ironmonger's at small cost in either cast iron or pressed steel. They are used to support a shelf which is somewhat less in depth than that ordinarily used to allow the ends of the brackets to project about $2''$ from the shelf. The wire is stretched taut across the space between the brackets after the wire-carrying insulators have been threaded on. There are two simple ways of anchoring one end of the wire so it can be kept tightly stretched. One of these is a screw eye and light turnbuckle as shown at A; the other is an eyebolt which can be adjusted by the nut to tighten the wire as shown at B, Fig. 11.

Another expedient is the use of a series of screw eyes on the front edge of the shelf, these being placed about a foot apart. The lamp may be provided

with a hook made of spring brass as shown at C, and this hook can be placed in any one of the screw eyes on the shelf front, or supported at any desired point on the wire stretched between the shelf brackets, if that is used. A simple shade that may be made of tin plate, springy brass, or other light, bright metal is shown at D, also the development or pattern, so it can be cut from flat stock and afterward bent up. It is an excellent idea to protect any lamp used on the workbench or in the shop with a wire cage guard to prevent lamp breakage in case it is dropped, or hit with a piece of wood or tool. A shock-absorbing spring holds the screen away from the lamp bulb, which is a feature of some value if high-efficiency lamps with fragile filaments are used. These guards may be purchased at small cost, and are made and installed as shown at Fig. 11, E.

Combined Sawhorse and Tool-carrier.—The handy man who makes repairs around the home cannot carry his tool outfit and workbench everywhere he goes, and usually finds that the tool he needs most is not in the selection he brought from the shop. For any odd jobs of carpentry work, either indoors or out, the combined sawhorse and tool-carrier shown at Fig. 12 will be found very useful. The box inside the frame serves a double purpose. It not only serves to strengthen the sawhorse frame materially by its bracing effect, but it acts as a container for a good assortment of tools. The trestle may be used for its normal use without trouble. It may be built

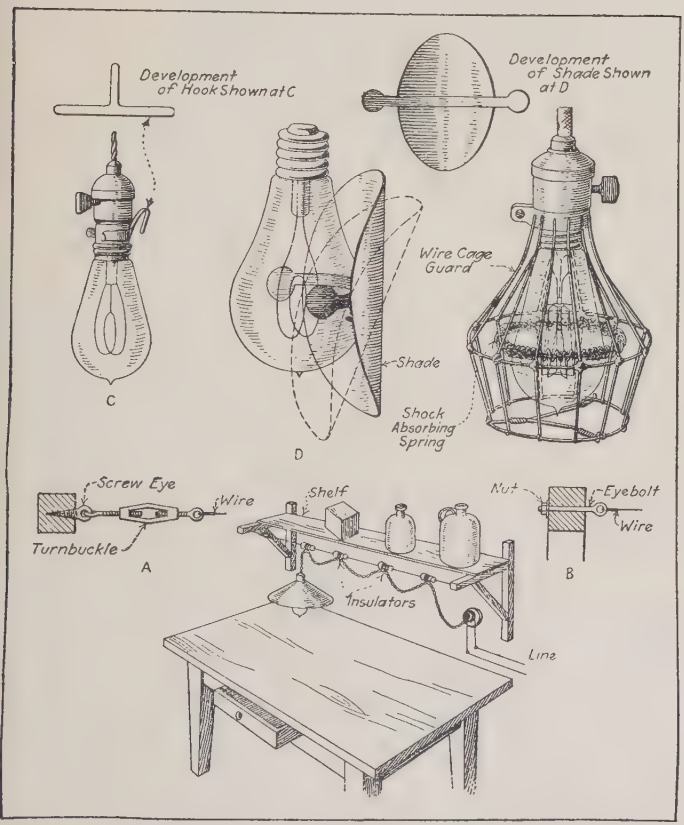

FIG. 11.—SUGGESTIONS FOR LIGHTING THE HOME WORKBENCH IF ELECTRICITY IS AVAILABLE.

by the home mechanic without any difficulty, by panelling one side and the two ends the full height around a bottom shelf, and putting on a front board to keep the tools from falling out. The dimensions given are merely for guidance ; the important point to be observed is to make the trestle as light as possible, so that it can be carried around without too much trouble. Stock $\frac{3}{8}''$ thick will be heavy enough for the box sides and ends, and the legs can be made of $\frac{7}{8}''$ thick boards.

Wood-working Tools.—No workshop will be complete without a set of wood-working tools, and fortunately a very practical outfit can be purchased at comparatively small cost. Wood-working tools are not only necessary in the home workshop, but are of obvious utility in making repairs incidental to the upkeep of buildings, and the many odd jobs about the house. A very convenient outfit for use around the farm or shop is shown at Fig. 13. It consists of the following tools : One 22″ hand saw, one 6″ try-square, one 2′ rule, one pair $5\frac{1}{2}''$ combination pliers, one 10″ bit brace, four auger bits, one each size $\frac{3}{8}''$, $\frac{1}{2}''$, $\frac{3}{4}''$, and 1″ ; five gimlet bits, one steel hammer, one 8″ draw knife, one double cutter spoke shave, one 5″ steel blade screwdriver, two socket chisels, one jack plane, one $5\frac{1}{2}''$ iron block plane, and a carpenter's pencil. A plumb bob and chalk line, nail set, level, and a large steel square can be purchased to complete this outfit at slight added expense, as well as other tools shown at Figs. 14 and 15.

The hardware necessary, such as nails, screws, staples, locks, hinges, etc., can be purchased as required, and soon enough of these supplies are left over when purchases are made from time to time, so that a very useful stock of miscellaneous small hardware accumulates without its cost being so apparent as would be the case if everything that was thought desirable was purchased outright.

As the skill of the workman increases, he may desire a more complete outfit than the simple and inexpensive tool chest at Fig. 13. For a variety of work, more tools are needed. The first saw to be purchased should be a "crosscut," or for cutting wood across the grain. For cutting wood with the grain, the crosscut saw will not be suitable, and a "rip" saw will be needed, as shown at Fig. 14. For cutting circles or arcs, one will need a compass or keyhole saw. For use with either a patent adjustable metal or simple wooden mitre box, a back saw will be needed, as the others are too coarse for cutting light wood or fine mouldings. The scroll or jig saw will be indispensable if pattern-making or model work is to be attempted.

The oilstone is needed for sharpening chisels, plane irons, and other edge tools. A compass or dividers is needed for laying out arcs, circles, or transferring measurements. The scratch gauge is for marking pieces that are to be rip-sawed. A set of gauges, which are really chisels having a curved cutting edge, for working out round channels will be necessary if pattern work is to be attempted.

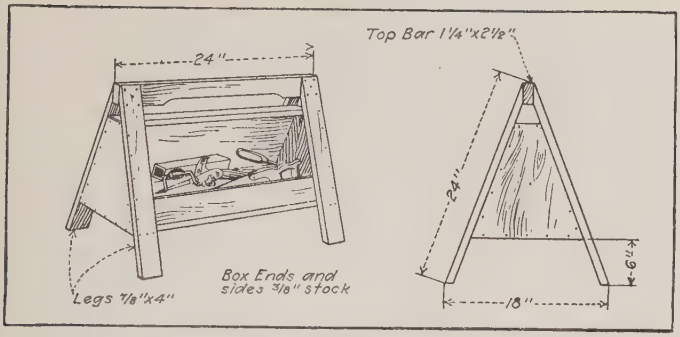

FIG. 12.—A COMBINED TOOL-BOX AND SMALL HORSE IS VALUABLE IN MAKING REPAIRS REMOTE FROM THE SHOP.

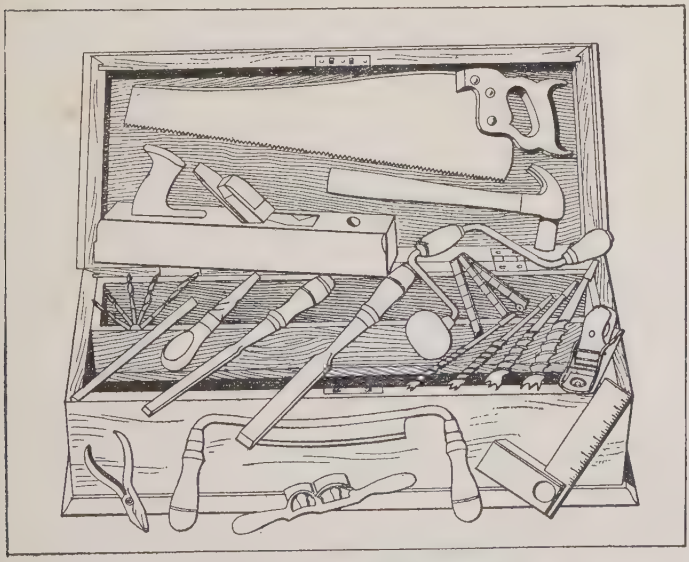

FIG. 13.—TOOL CHEST AND SIMPLE EQUIPMENT OF ORDINARY TOOLS USEFUL IN THE HOME WORKSHOP.

More useful tools are shown at Fig. 15. For general wood-work, especially on finished pieces, one should never use a claw hammer without interposing a block of wood to receive the force of the blow and to protect the surface. A wooden mallet is of value, in fitting jointed pieces, for hammering against chisel handles, and for all uses where the wood is not to be marred. Just as a metal hammer is not suitable for driving against wood, a wooden mallet should never be used against metal or for driving nails. The cutting pincers are handy in cutting off or drawing out small brads or nails that cannot be extracted with the claw hammer.

Cabinet scrapers are made in a variety of forms. The two illustrated are all the amateur needs. One having a broad, flat blade is used in scraping plane surfaces, the triangular blade form is used in small spaces and for corners. A hatchet is very useful, as it can be used for many rough jobs, such as pointing and driving stakes, splitting short boards, hewing roughly to a line so that planing can be done, opening boxes and crates, and many other uses that will suggest themselves.

Punches are valuable for making holes in leather, cloth, rubber packings, etc. Two kinds are ordinarily used: hollow punches, which are driven through the piece by hammer blows, and belt punches, which are operated like pliers. The file card is very handy in cleaning wood or metal dust from the teeth of files or rasps. A wood rasp is handy for roughing and finishing edges of wood pieces instead of a plane.

A glass-cutter and putty knife will be needed if any glazing is to be done.

The various types of wood-boring bits are shown at Fig. 16. The expansion bit is very useful, as it permits boring a large number of sizes with the one tool, which has an adjustable cutting lip. The reamer bit is used in connection with the bit stock for enlarging holes in metal, and is of tapering square or triangular section, having sharp cutting edges. The screwdriver bit is useful where a large number of screws are utilized to hold a piece.

Metal-working Tools.—Nearly all home craftsmen must work metal as well as wood, as that material enters largely into the construction of modern household appliances. As nearly everyone of a mechanical bent owns either a motor-cycle or automobile, or fusses around motor-boats, it is necessary to have a certain equipment of metal-working tools as well as those used on the less resisting material, wood.

Groups of hand and bench tools to be employed in fabricating or repairing parts made of metal are shown at Figs. 17 and 18, these cuts showing only the most common tools; but they include all of the tools necessary to complete a very practical kit, and it is not unusual for the handy man who is capable of overhauling his own car to possess even a larger assortment than indicated. The small bench vice provided is a useful auxiliary that can be clamped to the workbench, and should have jaws at least three inches wide and capable of opening four or five inches. It is especially useful in that it will

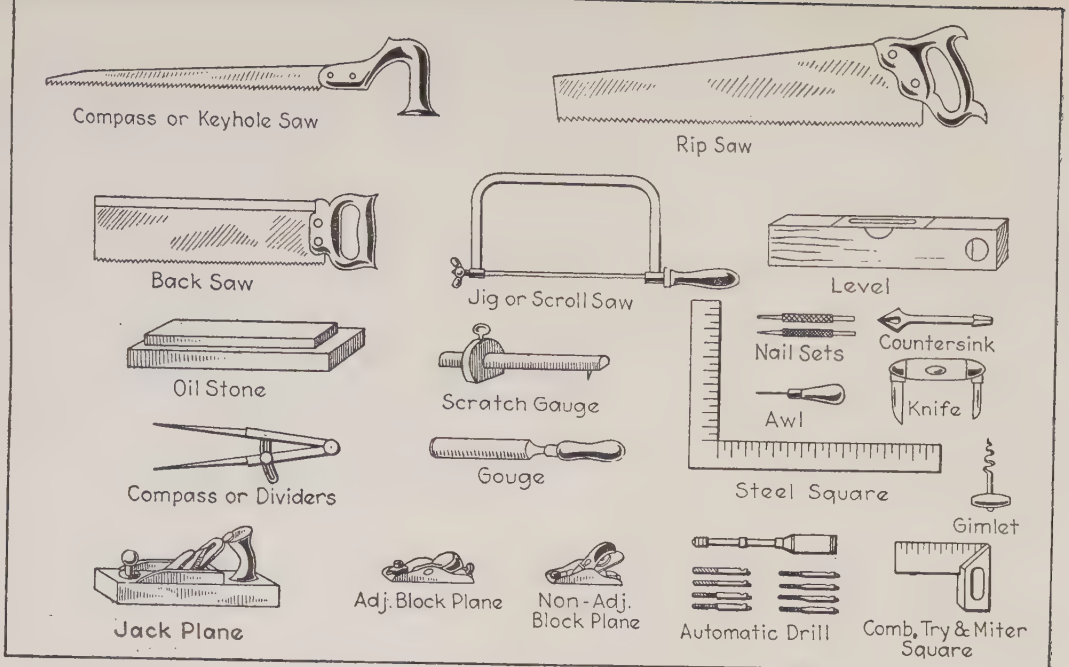

FIG. 14.—TOOLS THAT CAN BE USED TO SUPPLEMENT SIMPLE OUTFIT SHOWN IN FIG. 13.

save wood-working bench vices, as it has adequate capacity to handle practically any of the small metal parts that need to be worked on when making home repairs.

A blow torch, tinner's snips, and soldering copper are very useful in sheet-metal work, and in making any repairs requiring the use of solder. The torch can be used in any operation requiring a source of heat. The use of the wrenches, screwdrivers, and pliers shown are known to all, and the variety outlined should be sufficient for all ordinary work of restoration. The wrench equipment is more than usually complete, including a spanner wrench, adjustable end wrenches, a thin monkey wrench of medium size, a bicycle wrench for handing smal nuts and bolts, a Stillson wrench for pipe, and a large adjustable monkey wrench for all stubborn fastenings of large size.

Three different types of pliers are shown at Fig. 18, one being a parallel jaw type, with size-cutting attachment, while the other illustrated near it is a combination parallel jaw type adapted for use on round work as well as in handling flat stock. The most popular form of pliers is the combination pattern shown beneath the socket wrench set. This is made of substantial drop forgings, having a hinged joint that can be set so that a very wide opening at the jaws is possible. These can be used on round work and for wire-cutting, as well as for handling flat work.

A very complete set of files, including square, half

round, mill, flat bastard, three-cornered, and rat-tail are also necessary. A hacksaw frame and a number of saws, some with fine teeth for tubing and others with coarser teeth for bar or solid stock, will be found almost indispensable. A complete punch and chisel set should be provided, as shown at Fig. 19. A number of different forms and sizes of chisels are necessary, as one type is not suitable for all classes of work. The adjustable end wrenches can be used in many places where a monkey wrench cannot be fitted, and where it will be difficult to use a wrench having a fixed opening.

The Stillson pipe wrench is useful in turning studs, round rods, and pipes that cannot be turned by any other means. A complete mechanic's shop kit must necessarily include various sizes of Stillson and monkey wrenches, as no one size can be expected to handle the wide ranges of work the professional workman must cope with, but the home mechanic will find an 8″ size adequate for almost any work he will be called upon to do.

Two or three sizes of hammers should be provided according to individual requirement, these being small riveting, medium and heavy-weight machinists' hammers. A very practical tool of this nature for the home repair-shop can be used as a hammer, screwdriver, or tire iron. It is known as the "Spartan" hammer, and is a tool steel drop forging in one piece, having the working surfaces properly hardened and tempered, while the method is distributed so as to give a good balance to the head

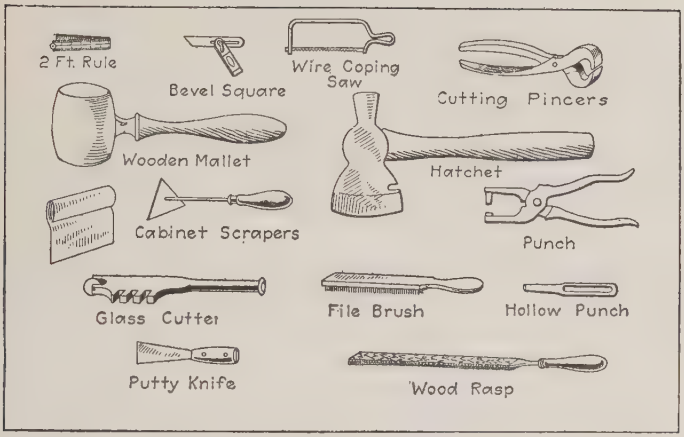

FIG. 15.—MORE TOOLS THAT WILL PROVE TO BE USEFUL ADDITIONS TO THE HOME SHOP OUTFIT.

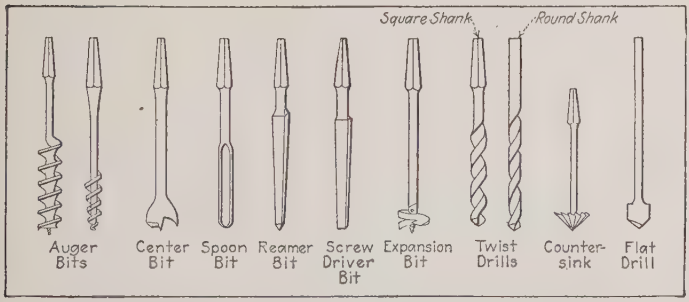

FIG. 16.—WOOD-BORING TOOLS ARE MADE IN MANY FORMS, AND MAY BE USED IN BITSTOCK OR HAND-DRILL PRESS,

and a comfortable grip to the handle. The hammer head provides a positive and comfortable T-handle when the tool is used as a screwdriver or tire iron. Machinists' hammers are provided with three types of heads, these being of various weights. That shown is the form most commonly used, and is termed the " ball pein " on account of the shape of the portion used for riveting.

Mention has been previously made of the importance of providing a complete set of files and suitable handles. These should be of various grades and degrees of fineness, and three sizes of each kind should be provided if a complete equipment is desired. In the flat and half-round files three grades are necessary, one with coarse teeth for roughing, and others with medium and fine teeth for the finishing cuts. The round or rat-tail file is necessary in filing out small holes, the half-round for finishing the interior of large ones. Half-round files are also well adapted for finishing surfaces of peculiar contour, such as the inside of bearing boxes, connecting rod and main bearing caps, etc. Square files are useful in finishing keyways or cleaning out burred splines, while the triangular section or three-cornered file is of value in cleaning out burred threads and sharp corners. Flat files are used on all plane surfaces.

A file brush consists of a large number of wire bristles attached to a substantial wood back, having a handle of convenient form so that the bristles may be drawn through the interstices between the teeth

of the file to remove dirt and grease. If the teeth are filled with pieces of soft metal, such as solder or babbitt, it may be necessary to remove this accumulation with a piece of sheet metal.

One of the most widely used of the locking means to prevent nuts or bolts from becoming loose is the simple split pin, sometimes called a " cotter pin." These can be handled very easily if the special pliers shown at Fig. 19, A, are used. These have a carved jaw that permits of grasping the pin firmly and inserting it in the hole ready to receive it. It is not easy to insert these split pins by other means, because the ends are usually spread out, and it is hard to enter the pin in the hole. With the cotter-pin pliers the ends may be brought close together, and as the plier jaws are small, the pin may be easily pushed in place. Another use of these pliers, also indicated, is to bend over the ends of the split pin in order to prevent it from falling out. To remove these pins, a simple curved lever, as shown at Fig. 19, B, is used. This has one end tapering to a point, and is intended to be inserted in the eye of the cotter pin, the purchase offered by the handle permitting of ready removal of the pin after the ends have been closed by the cotter-pin pliers.

A complete chisel set, suitable for repair-shop use, is also shown at Fig. 19. The type at C is known as the " cape " chisel, which has a narrow cutting point and is intended to chip keyways, remove metal out of corners, and for all other work where the cutting edge chisel, shown at D, cannot be used. The form

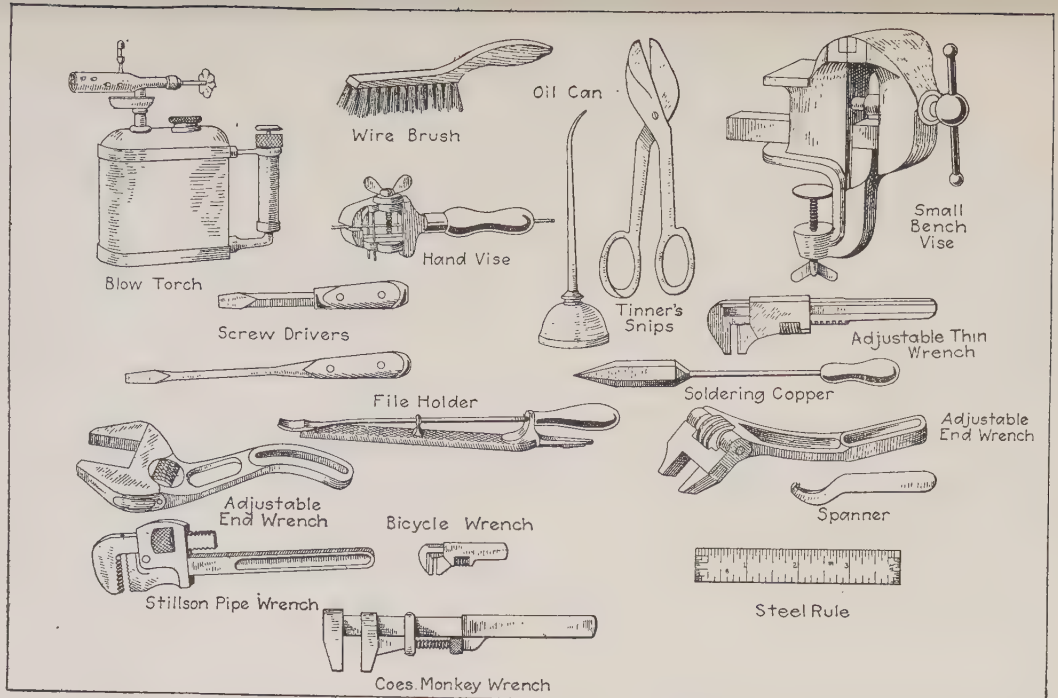

FIG. 17.—GROUP OF METAL-WORKING TOOLS THAT THE HOME MECHANIC WILL FIND INDISPENSABLE.

with the wide cutting edge is used in chipping, cutting sheet metal, etc. At E a round-nose chisel used in making oil ways is outlined, while a similar tool, having a pointed cutting edge, and often used for the same purpose, is shown at F. The centre punch depicted at G is very useful for marking parts either for identification or for drilling. In addition to the chisels shown, a number of solid punches or drifts, resembling very much that shown at E, except that the point is blunt, should be provided to drive out taper pins, bolts, rivets, and other fastenings of this nature. These should be provided in common sizes. A complete set of real value would start at $\frac{1}{8}''$, and increase by increments of $\frac{1}{32}''$ up to $\frac{1}{2}''$. A simple spring winder is shown at Fig. 19, H, this making it possible for the repairman to wind coil springs, either on the lathe or in the vice. It will handle a number of different sizes of wire, and can be set to space the coils as desired.

Drilling machines for the home mechanic are usually hand-operated. For drilling small holes in metal it is necessary to run the drill fast, therefore the drill chuck is usually driven by gearing in order to produce high drill speed without turning the handle too fast. A small hand drill is shown at Fig. 18.

As will be observed, the chuck spindle is driven by a small bevel pinion, which in turn is operated by a large bevel gear turned by a crank. The gear ratio is such that one turn of the handle will turn the chuck five or six revolutions. A drill of this

design is not suited for drills any larger than $\frac{1}{4}''$. For use with drills ranging from $\frac{1}{8}''$ to $\frac{3}{8}''$, or even $\frac{1}{2}''$ in diameter, a breast drill is required, this being a larger form of hand drill, and is also illustrated at Fig. 17. A set of number drills suitable for the home mechanic's workshop, set in a metal base block, is shown at Fig. 18. This includes all sizes that are apt to be required in work about the home. A steel rule and inside and ouside calipers are also of value.

Supplies for Home Workshop.—Without knowing the character of the work the home mechanic will attempt, it is not possible to give definite advice about the supplies that should be available. All of the material mentioned can be used at some time or other, and can be purchased as required. In buying nails, screws, nuts, and numerous small items of hardware, one can sometimes purchase a quantity for but little more than a few will cost. One can often secure a gross of screws in a box as cheaply as a few dozen counted out in an envelope. Always ascertain the cost of an unbroken package containing a small standard quantity before buying an odd amount, which might result in breaking the package and cost fully as much.

The items of hardware most used in the home workshop are: wood screws, stove bolts, nails, brads, tacks, both carpet and curtain, escutcheon pins, small rivets, screw-eyes and screw-hooks in both steel and brass and various sizes; a few sizes of nuts and bolts, iron washers, split pins, hose

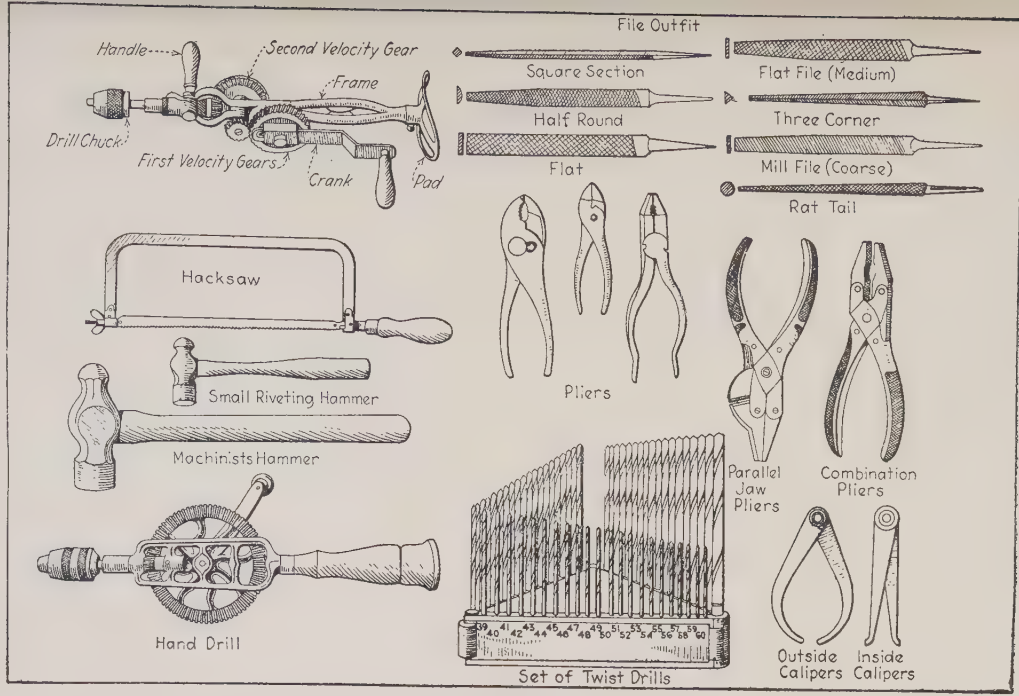

FIG. 18.—METAL-WORKING TOOLS THAT CAN BE PROFITABLY ADDED TO THE HOME WORKSHOP EQUIPMENT.

clamps, wire solder, picture-hangers' wire, spool of bare copper wire about No. 16, and a coil of soft iron wire of the same size. Large screws and upholsterers' tacks will be needed if furniture is made or repaired.

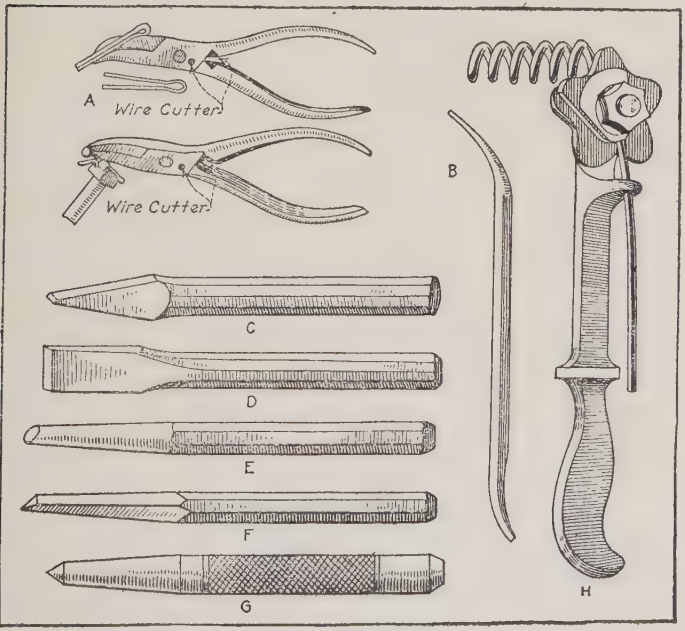

FIG. 19.—COTTER-PIN PLIERS SHOWN AT A; COTTER-PIN EXTRACTOR SHOWN AT B; CHISEL AND PUNCH SET, C TO G INCLUSIVE; SPRING WINDER AT H.

Both emery-cloth and sandpaper in various grades should be stocked. Electrical tape can be used for many purposes besides that of insulation, and a roll should always be handy.

A number of paints and chemicals will also be

useful. Some carbon tetrachloride for cleaning purposes ; white and orange shellac ; alcohol ; stovepipe black ; enamels and paints as required ; turpentine and linseed oil ; aluminium and bronze powder, banana oil lacquer, glue for wood ; rubber cement, putty, asbestos cement, beeswax and rosin, potash, or lye ; machine oil ; 3 in 1 oil ; furniture polish ; wood stains and furniture wax ; white or red lead ; Smooth-on cement for metal, and ample supplies of waste and cleaning rags.

A fireproof receptacle should be provided for wood shavings, dirty cloths, oily waste, and other inflammable material. A small galvanized iron can, such as is used for garbage, is very good for this purpose. The hinged cover keeps the contents inside the can, and there is no danger of fire. A push-broom, a dust-pan, and a bench brush will also help in keeping the shop clean and make it a pleasant place to work in.

CHAPTER II

SPECIAL TOOLS AND SHOP EXPEDIENTS

Two-foot Rule for Laying Out Angles—Lamps for Fine Soldering—Soldering-iron Heater—Non-spilling Acid Cup—Home-made Blow Lamp—Improvised Tools—Wooden Hacksaw Frame—Cabinet Scraper Handle—Inexpensive Marking Gauge—Stunts with Hammers—Soft-faced Hammer—Wedging Hammer Handles Securely—Stowing Away the Nail Set—Repairing Cracked Hammer Handle—Emergency Wrench for Turning Pipe—Hint for Sharpening Skates—Small Jaws for Holding Screws—Home-made Expanding Bolt—Insulating Plier Handles—Use of Drill Gauge—Removing Stud Bolts—Simple Saw Clamp—Extemporized Sawing Gauge—Repairing Wood-boring Bits—Screw-inserting Tool—Soldering-iron Hints—Simple Pipe Wrench—Using Wrench for Pipe-cutting—Suggestions for the Home Painter—Simple Paint Brush Wiper—Keeping Brush Handle Clean—Handle Hook—Extension Handle for Brush

THE special tools and simple devices described in this chapter cannot fail to be of value to the home mechanic, who must often extemporize ways of doing things with the ordinary tools in his equipment, whereas the professional always has special tools for the work in hand. All of the suggestions which follow have been tried by handy men, and have been found useful in shop work and around the home.

Two-foot Rule for Laying Out Angles.—If it is desired to lay out angles, and a protractor is not available, it is possible for the handy man to use a 2′ rule for this purpose, and secure fairly accurate results if he refers to the table given at Fig. 20. In operation the rule is opened varying amounts depending on the angle desired, and the distance is measured between the edges of the rule. For example, if one wished to lay out a 15° angle, by consulting the table it will be found that the distance is $3\frac{1}{8}$″. Similarly, a 30° angle could be obtained by spreading the ends of the folded rule $3\frac{6}{32}$″—$3\frac{7}{32}$″. Distances given are accurate within $\frac{1}{32}$″, and are believed to be sufficiently accurate for practical use. The only way to obtain angles accurately is by using a protractor.

Lamps for Fine Soldering.—A very simple alcohol lamp is shown at Fig. 21, A. This is made by cutting a tube from the brush of an old mucilage bottle, and by threading some cotton wicking down through the tube. Any piece of copper or brass tube of suitable size may be used if desired. A cork is selected that will fit the bottle tightly, and the end of the tube passed through it so that the lower portion of the wicking will project into the alcohol. In order to prevent evaporation, the outer end of the wick should be covered with some form of tubular member such as an old cartridge shell. Another simply-made spirit lamp is shown at B. This is contrived from an old spring bottom oil can, the spout of which is cut up close to the can body, and wicking passed

Table for Determining Angles by a Two-Foot Rule.

B	A	B	A	B	A	B	A	B	A	B	A
Deg.	Inch	Deg.	Inch	Deg.	Inch	Deg.	Inch	Deg.	Inch	Deg.	Inch
1	7/32	16	3 1/32	31	6 7/16	46	9 3/8	61	12 3/16	76	14 27/32
2	7/16	17	3 17/32	32	6 5/8	47	9 9/16	62	12 3/8	77	14 15/16
3	5/8	18	3 3/4	33	6 13/16	48	9 3/4	63	12 9/16	78	15 3/32
4	27/32	19	3 31/32	34	7 1/32	49	9 31/32	64	12 23/32	79	15 1/4
5	1 1/32	20	4 5/32	35	7 7/32	50	10 5/32	65	12 29/32	80	15 7/16
6	1 1/4	21	4 3/8	36	7 7/16	51	10 11/32	66	13 3/32	81	15 19/32
7	1 15/32	22	4 19/32	37	7 5/8	52	10 17/32	67	13 1/4	82	15 3/4
8	1 11/16	23	4 25/32	38	7 13/16	53	10 11/16	68	13 7/16	83	15 29/32
9	1 7/8	24	5	39	8 1/32	54	10 29/32	69	13 19/32	84	16 1/16
10	2 3/32	25	5 3/16	40	8 7/32	55	11 3/32	70	13 3/4	85	16 7/32
11	2 5/16	26	5 13/32	41	8 13/32	56	11 1/4	71	13 15/16	86	16 3/8
12	2 1/2	27	5 5/8	42	8 19/32	57	11 15/32	72	14 3/32	87	16 17/32
13	2 11/16	28	5 13/16	43	8 13/16	58	11 5/8	73	14 9/32	88	16 11/16
14	2 29/32	29	6	44	9	59	11 13/16	74	14 7/16	89	16 29/32
15	3 1/8	30	6 7/32	45	9 3/16	60	12	75	14 5/8	90	17

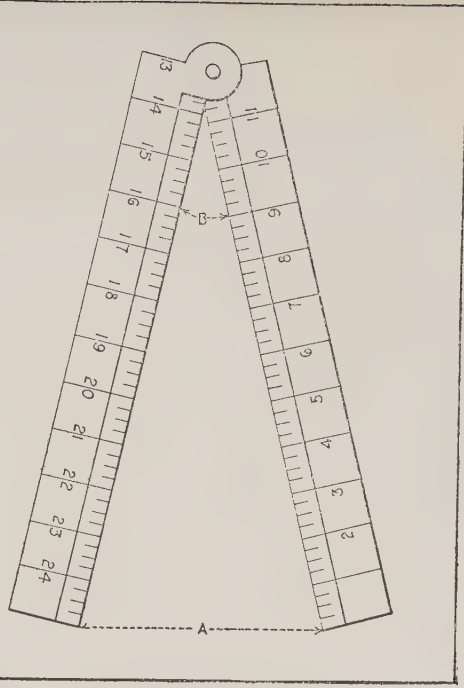

FIG. 20.—HOW TO USE A TWO-FOOT FOLDING RULE IN LAYING OUT ANGLES.

through it as indicated. Either of these alcohol lamps can be used if doing small soldering jobs, and for heating small irons.

Soldering-iron Heater.—It is possible to use ordinary pipe fittings and make a somewhat more

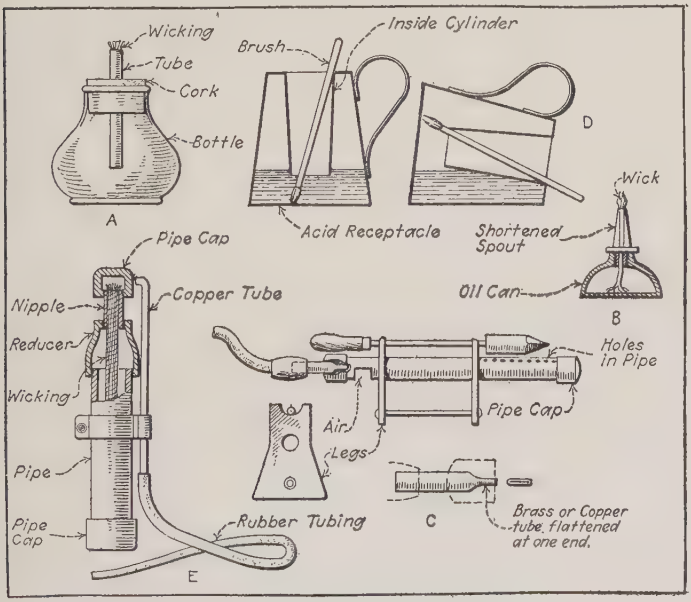

FIG. 21.—ALCOHOL LAMPS, ACID RECEPTACLE, BLOW LAMP, AND SOLDERING-IRON HEATER MAY ALL BE MADE IN THE HOME WORKSHOP.

pretentious soldering-iron heater, as shown at Fig. 21, C. The main part is composed of a 12″ piece of $\frac{1}{2}$″ iron pipe, provided with threads at each end, on which ordinary pipe caps are screwed. A series of holes $\frac{1}{16}$″ in diameter, and in two or three

rows, is drilled to extend about 4″ from one end. At the other end a small piece of the pipe is cut out to form a rectangular opening through which air can come and mix with the gas. Pieces are cut from sheet metal to form legs as indicated, these being provided with a hole through which pipe is passed, and are extended up above the pipe sufficiently high to form a rest for the soldering iron. A nozzle for the gas burner is made of a piece of $\frac{1}{8}$″ pipe about 4″ long, which is flattened at one end as indicated. This is inserted into the cap at the end of the pipe opposite the drilled holes, through a hole provided for that purpose in the cap. The pipe should be a tight fit in the end of the cap, and should be moved back and forth until the proper flame is obtained at the other end of the pipe. It is connected to the house gas fitting by means of the usual rubber gas-tube. If the flame is too red or yellow, which indicates too much gas, the end of the small pipe may be flattened more to restrict the amount of gas-supply to the mixture to be burned. When the parts are properly adjusted, a series of blue flame such as in a gas-stove will result when the gas and air mixture issuing from the small holes is ignited.

Non-spilling Acid Cup.—A receptacle for soldering acid that will not spill its contents out, even if tipped over, is shown at Fig. 21, D. This is a double cup which has an inside cylinder to form a partition to keep the acid from leaking out if the container is lying on its side. A very good size is to make the main cup about 3″ high, with a diameter at the

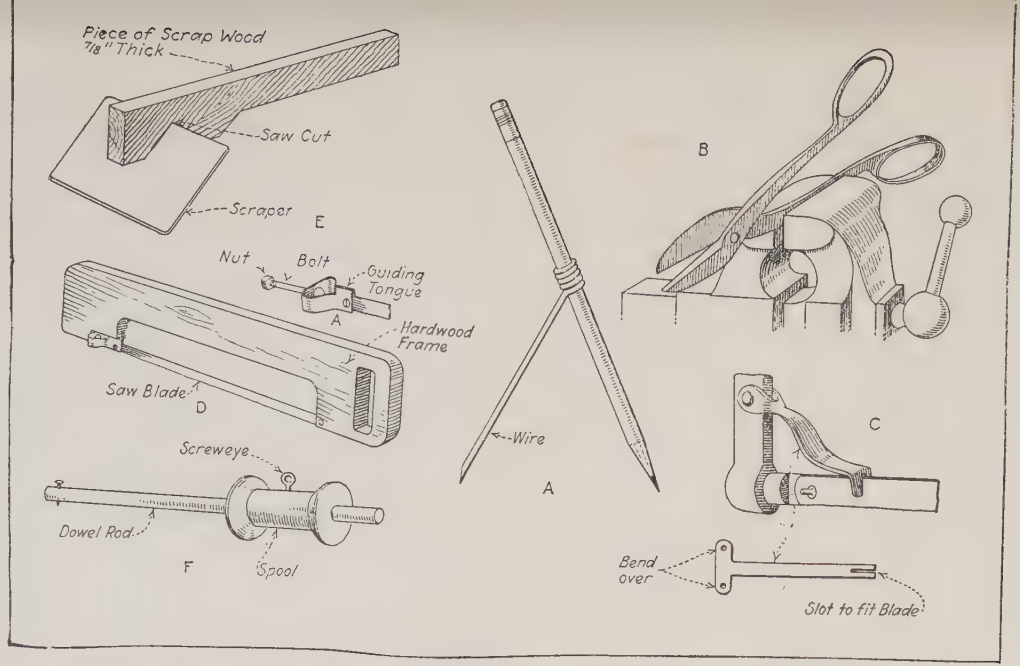

FIG. 22.—A, EXTEMPORIZED PENCIL COMPASS. B, HOW TIN SNIPS CAN CUT HEAVY GAUGE METAL. C, SIMPLE THUMB-REST FOR HACKSAW. D, HOME-MADE HACKSAW FRAME. E, CABINET SCRAPER HANDLE. F, ECOMONICAL SCRATCH GAUGE.

bottom of 2″, and at the top of 1½″. The inside cylinder, in which a brush is inserted, may be 1″ in diameter at the top, tapering down to ¾″ at the lower end. The inner cylinder is joined to the outer cup by a flat ring of metal securely soldered to both cup and top of cylinder. The handle shown may be added as a convenience, but is not absolutely necessary. This is made of a piece of strip stock riveted to the cup before the parts are assembled. In order to prevent leakage of acid, the riveted points should be well soldered. Copper is very good material for making a soldering-acid cup as shown.

Home-made Blow Lamp.—Many useful devices may be made of pipe fittings by the home mechanic. The blow lamp, which is shown at Fig. 21, E, is of substantial construction and will give very good results. A 1″ pipe nipple 6″ long is fitted with a reducing coupling at one end and a pipe cap at the other. A ½″ pipe nipple 1½″ long is screwed into a reducer at one end, and is provided with a suitable cap at the other. The wick is made by bunching a sufficient number of strands of lamp cord or candle wicking to fill a ½″ pipe nipple, and to extend from one end of that member down into the body of the torch. The blow pipe is made of a piece of copper tube about 8″ long, bent over at the top, and attached to the reservoir by a simple sheet metal clamp. A couple of feet of rubber tube is attached to the lower end of the blow-pipe tube.

The pipe cap at the top keeps the alcohol, with which the container is filled, from evaporating, and

should always be screwed on when the lamp is not in use. If a brass pipe is employed to form the reservoir, the lower cap may be soldered to prevent leakage. If iron pipe is used, a paste of red lead and glycerine may be applied to the threads of the cap before it is screwed in place. The method of using a lamp of this kind is very simple. The wick is lit as in any alcohol lamp, and air is blown through the rubber tube, which is placed in the mouth of the operator to direct the flame to the point it is desired to heat.

Improvised Tools.—It often happens that one is in need of a compass for describing circles, and a compass is not available. If one has a pencil, it is not difficult to contrive a satisfactory substitute by taking a length of steel wire and winding several coils around the pencil body as shown at Fig. 22, A. The lower end of the wire is sharpened to a point, and circles of varying radius may be made by bending the wire to obtain the desired distance between the pencil point and that of the wire.

In cutting sheet metal that is too heavy to be cut with the ordinary tin snips held in the hand, or for cutting irregular shapes where the sheet of metal must be manipulated, much better results are obtained if the snips are held between the vice jaws as indicated at Fig. 22, B, as more pressure can be exerted on the one movable blade than when they are held in the hand and both blades have pressure exerted to close them.

If one has a large number of pieces of metal to

saw with ordinary hacksaw, considerable discomfort may result from the cramped position of the thumb, which imparts pressure to the end of the hacksaw frame opposite the handle, and which is necessary not only to feed the saw into the piece cut, but also to steady it. A simple thumb-rest may be made of sheet metal, as shown at Fig. 22, C. The metal must be of sufficiently heavy gauge not to lose its shape when pressure is applied. It is supported at the front end by a hinge at the hacksaw frame, and is slotted at the other, so that it will bridge the sawblade and not slip off. The slot is made so that it will fit the hacksaw blade accurately, and thus it provides a stiffening effect that is valuable in sawing certain metals. The method of application and the development of this piece before it is bent is clearly shown at Fig. 22, C. The reason it is attached to the frame is so that it will not be misplaced, and so that it can be swung out of the way when blades are changed.

Wooden Hacksaw Frame.—While hacksaw frames are not expensive, and may be purchased at a hardware store for comparatively little money, the handy man may desire to make his own saw frame, which he can easily do by following the design sketch given at Fig. 22, D. The frame is made of hard wood, and a slot is provided at both ends of the arch to receive the end of the blade or the guiding fin of the tension fitting. A cotter pin or small bolt serves to hold the end of the hacksaw blade near the handle. The other end of the blade is supported by a bent

metal clip, which is provided with a bolt passing through the wooden handle, and having a nut at its outer end by which the blade may be tightened by pulling the tension member closer to the frame end. The blade is kept from turning by a projecting feather that sticks up into the slot cut above the tension fitting.

Cabinet Scraper Handle.—Another tool that may be easily improvised is a handle for a steel plate cabinet scraper shown at Fig. 22, E. Any piece of scrap hardwood may be utilized, cut approximately to the shape outlined, and a saw cut made on an angle to fit the scraper steel tightly. This makes it considerably easier to handle the thin scraper blade than when held in the hand.

Inexpensive Marking Gauge.—A very simple and effective marking gauge may be made at slight expense as shown at Fig. 22, F. A piece of dowel rod or a round stick is whittled out and dressed down so that it will fit the hole in a large spool tightly. A small brad is driven part way through one end so that its point projects through about $\frac{3}{32}''$. The adjustment of the gauge is easily accomplished by moving the spool as desired on the tightly fitting round stick of wood. Another way is to use a screw eye as a clamp screw, which is screwed into the spool, but which has a flattened end, so that it will not cut into the central rod. When this is done, the spool need not fit tightly. If desired, a small piece of steel or brass rod may be used instead of the wooden piece, in which case

a hole will have to be drilled at one end, in which a suitable metal point is placed.

Stunts with Hammers.—The ordinary claw hammer, which is such an indispensable tool in the home workshop, is not suitable for pulling tacks or very small brads. The simple expedient of filing a notch in one of the claws as indicated at Fig. 23, A, adapts it perfectly for pulling out small tacks, and makes the use of a separate tack-puller unnecessary.

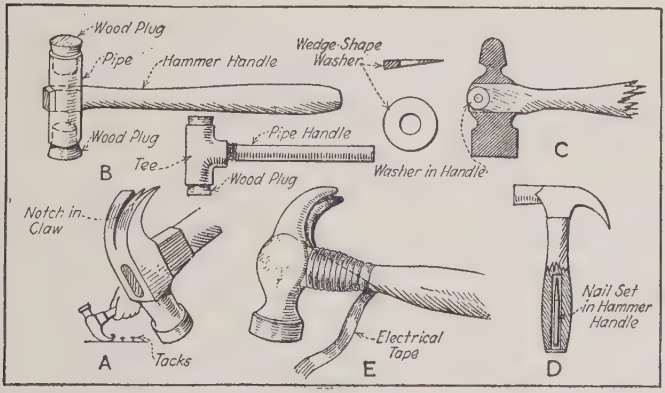

FIG. 23.—STUNTS WITH HAMMERS.

Soft-faced Hammer or Mallet.—For working on polished metal surfaces or finished wood pieces, or for driving out threaded members such as bolts, without marring the threads, a soft-faced hammer may be contrived as shown at Fig. 23, B. A piece of iron pipe about $1\frac{1}{2}''$ in diameter and $3''$ long forms a basis of this tool. Two holes are drilled through close to each other, and then filed square so that an

ordinary hammer handle may be wedged in. The soft faces are made of soft wood plugs tapered so they may be driven into the ends of the pipe. When the plugs become worn, they may be easily replaced at slight expense. By using a short piece of wood several inches in diameter and 3″ long, and drilling a hole in the centre for a handle, it is not difficult to make a mallet that will prove useful on different kinds of wood-work.

Wedging Hammer Handles Securely.—There is nothing more annoying than to have a loose hammer head on a handle. The ordinary forms of simple wood or iron wedges do not always stay in place, which is the main cause of the looseness. An expedient that is recommended is to take an iron washer that will fit into the eye of the hammer, and grind it wedge-shape as shown at Fig. 23, C. After the wedge is driven in place, part of the wood of the handle will swell into the opening in the washer, and the wedge thus made will remain firmly in place. A washer larger than the eye of the hammer may be used by grinding off two points on the circumference to obtain flat pieces, and thus reduce the washer diameter. An ordinary metal wedge may be used by drilling the hole through it, but a washer is recommended because these are usually available, and as they are made of soft iron they may be filed tapering if an emery wheel is not available for grinding it down.

Stowing away the Nail Set.—Where much nailing is to be done, it is not always easy to keep the nail

set handy, as this is a small tool that is easily misplaced, and so shaped it may roll off the bench on the slightest provocation. The sketch at B, Fig. 23, shows a simple expedient for carrying the nail set so it will not be lost and will be available when wanted. A hole slightly larger in diameter than the nail set, and about $\frac{1}{8}''$ longer, is drilled into the end of the hammer handle. A small plate held by a screw serves as a cover to keep the nail set from falling out, and can be swung to one side when the nail set is needed.

Repairing Cracked Hammer Handle.—Hammer handles sometimes break off near the head, especially if the hammer is used for work it is not designed for, such as trying to pull out spikes or using the hammer head or handle as a pry. Sometimes the handle does not break off, but cracks. In this case the fractured portion may be tightly wound with electricians' tape, which reinforces the weakened portion. Some mechanics have wound closely spaced copper wire coils tightly around the cracked portion and extending beyond the break. In order to keep the copper wire in place it is soldered, and then it becomes a solid metal sleeve that is a very effective reinforcement for the weak handle.

Emergency Wrench for Turning Pipe.—The home workshop cannot be expected to contain the assortment of tools that is found in professional establishments. Sometimes it is necessary to turn pieces of pipe or other round objects that are beyond the capacity of the Stillson wrench or pipe pliers in

the home tool kit. In this case the expedient outlined at Fig. 24 provides a very good form of pipe wrench. A pipe tee and a foot or more of pipe forms the basis of the tool, and a piece of chain which is wound around the pipe and passed through the tee piece as indicated will give a very firm grip on the pipe.

Hint for Sharpening Skates.—The home mechanic is often called upon to sharpen skates. It is not difficult to dress the blades down flat, but it is hard to produce the hollow-ground effect unless one employs the method depicted at Fig. 24, B. A simple guide clip is made of sheet metal, so that the round file used in hollowing the skate blade is guided and cannot slip off. The guide clip is moved back and forth with the file. This method can only be employed on the cheaper grade of skates that have soft steel blades. Higher grade skates have harder steel surfaces that can only be machined by means of an emery wheel or oilstone.

Small Jaws for Holding Screws.—Inexpensive jaws to be used in a small bench vice for holding screws for slotting, or for filing down the ends of the thread without injuring the threaded surface, may be readily made by sawing through a nut that will fit the screw and filing a ledge so that the nut will drop through the vice while it is being tightened. Small screws may be held by nuts that are not slotted all the way through, but only through one side. It will be evident that the screws will be very firmly held without any injury to the threads.

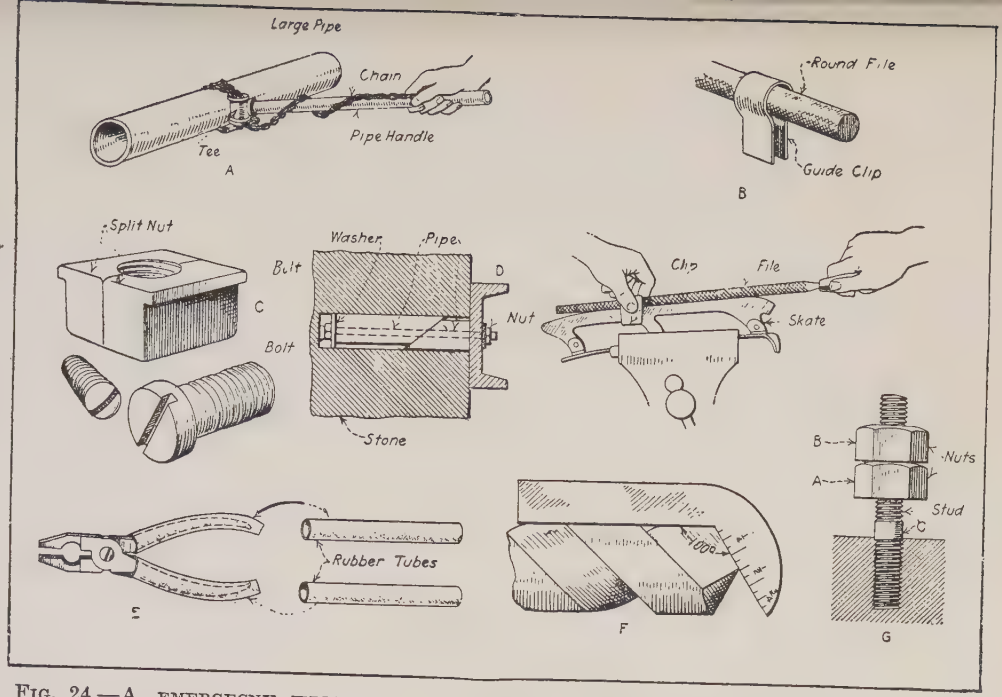

FIG. 24.—A, EMERGECNY WRENCH FOR UNSCREWING LARGE PIPE. B, HOW TO FILE SKATE BLADES CONCAVE. C, VICE JAW FOR HOLDING SCREWS WITHOUT MARRING THREADS. D, SIMPLE EXPANSION BOLT. E, INSULATED HANDLE PLIERS. F, USE OF DRILL GAUGE. G, HOW TO REMOVE STUD BOLT.

Home-made Expanding Bolt.—In fastening objects to brick walls or other masonry, expansion bolts are necessary because it is not possible to thread such materials, and wooden plugs driven in holes drilled do not always provide a strong enough anchorage. A simple method of making an expansion bolt is outlined at Fig. 24, D. A short piece of gas-pipe of the required diameter and length is divided by a slanting cut made with a hacksaw. The bolt is passed through the centre, and as the nut is tightened up, the tapering ends of the pipe slide on each other, which increases the effective diameter of the pipe at that point, causing it to clamp firmly against the material at the sides of the hole because of its expanded diameter.

Insulating Plier Handles.—In working around wires comprising electrical circuits, especially if these carry lighting or power current, the workman will find insulated plier handles useful. While pliers with very good handles may be obtained, from any ironmonger, in which an insulating composition is vulcanized to the metal, the home workshop can be supplied with a very satisfactory substitute. As shown at Fig. 24, E, pieces of rubber hose or tube are cut to correspond to the length of the handles, and forced over them as indicated. This makes a very satisfactory insulation that will resist ordinary voltages used for power and lighting circuits.

Use of Drill Gauge.—Grinding a twist drill so that it will cut well and to size is not a difficult

proposition if a drill grinding gauge such as shown at Fig. 24, F, is used. This insures that both lips of the drill will be ground to the same angle as the gauge, and that both lips will measure the same. If one of the lips is ground at a different angle than the other or is longer, the drill will not feed freely into the metal, and will make an oversized hole. The angle generally adopted for drill lips is approximately 100 degrees.

Removing Stud Bolts.—A very simple method of removing stud bolts is shown at Fig. 24, G. This is much better than the usual method of using pipe pliers or a Stillson wrench on either the body or the threaded part. Two nuts are used, one to lock the other firmly on the thread and keep it from coming off. The stud is unscrewed by applying a wrench to one of the nuts, while the other is kept firmly seated against it by another wrench.

Simple Saw Clamp.—A very simple saw clamp that can be used advantageously, if it is necessary to sharpen the saw teeth and no regular clamp is available, may be made as shown at Fig. 25, A. In this a piece of board or timber is ripped for a depth of half that of the saw-blade, and then the saw is dropped into this groove. As the groove is larger than the gauge of the saw-blade, it is necessary to clamp that member by driving small wedges or slivers of wood between the blade and the wood at one side of the slot. This experiment enables one to hold a saw at such a height above the bench as will permit easy and accurate filing,

which is not always possible if the saw is placed in a bench vice, which is usually too low for the purpose.

Extemporized Sawing Gauge.—A workman who had several trestles to make, and no mitre box handy, extemporized a mitre cutting gauge that proved to be very satisfactory, as shown at Fig. 25, B. Ordinarily it would have been necessary to lay out an angle on each leg separately as a guide for sawing, but with the mitre box that was contrived on the job, it was possible to cut all the legs accurately and at the same angle. The base angle was made of stock the same thickness as that used for the legs. Three pieces of $\frac{7}{8}$″ board were nailed to this base piece in such a position as to guide the saw at the proper angle for cutting the mitre. A nail driven in one of the upright pieces to act as a stop, and the single piece at the other end of the base member, formed a useful gauge for cutting the legs to the correct length, as well as holding the legs steady while being sawed. The positions of the guide pieces may be changed to suit the requirements, and the suggestion given can be employed to advantage by the home mechanic whenever a number of duplicate pieces are to be sawed.

Repairing Wood-boring Bits.—When the spurs on wood-boring bits cut the hole smaller than the size of the twisted portion, as results when they become bent in, it is easy to restore them to the normal cutting position in the manner shown at Fig. 26, A. A small nail set or light punch is used

to drive the spurs back in line. In order to do this, the bit is placed on a level surface and the spurs driven out by blows from a light hammer so that it will be a little wider apart than the diameter of the twisted part of the bit. Both spur points should be the same distance away from the centre screw point. If the lips become dull, they may be dressed down with a fine file or small oil-stone,

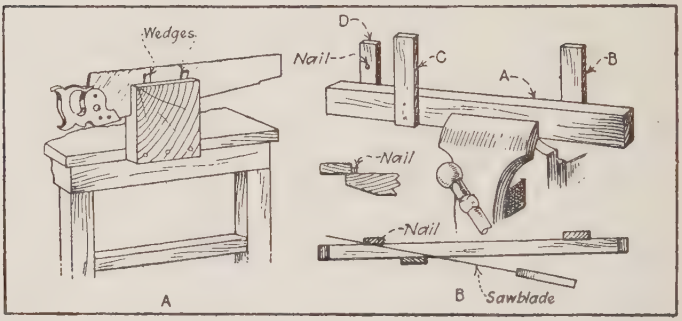

FIG. 25.—SIMPLE SAW CLAMP AT A. B, GAUGE FOR SAWING TRESTLE LEGS.

the centre screw may be sharpened with a small three-cornered file.

Screw-inserting Tool.—When fussing around on small work, as in clock repairing or tinkering with a sewing machine, and even on auto repairing, it is sometimes necessary to insert small screws that are difficult to hold with the hand and leave room enough to work a screwdriver. The tool shown at Fig. 26, B, greatly facilitates this work. It may be made in various sizes, depending on the

screws to be handled. The end of the tool, which is made like a screwdriver, is slotted, so that it may be sprung into the slot in the screw head. After the screw is started, the ordinary screwdriver can be employed to finish the job.

Soldering Iron Hints.—When it is necessary to do soldering in spaces where the ordinary pyramidical soldering iron as shown at C, Fig. 26, cannot be used to advantage, the special shape depicted at D will be found valuable. One side is absolutely flat, while the other three sides taper to a point as in the usual construction. The advantage of this shape is that it permits of heating seams better than the usual form, on account of the greater area of the iron in contact with the metal to be heated, and also because more of the tinned surface of the iron is in contact with the portion to be soldered.

A simple expedient to keep a hot soldering iron from burning a wooden benchtop is shown at Fig. 26, C. The large iron washer or disc of metal with a hole drilled through serves as a rest to keep the soldering copper head away from the wood. This washer, being a loose fit on the shank, can be slipped back to the handle when the iron is heated or when it is in use.

Simple Pipe Wrench.—An ordinary monkey wrench may be changed to a pipe wrench by providing an easily made serrated jaw which is held in place against the movable end jaw by a spring clip. When not in use as a pipe wrench, the toothed

piece and its holding clip may be removed and the wrench used in the usual manner.

Using Wrench for Pipe-cutting.—A large wrench may be fitted with a pair of hardened steel cutters as shown at Fig. 26, F, so it becomes a pipe-cutter that can be used very well in an emergency. The discs are held in place by pins or bolts which fit in the suitable holes drilled into the wrench jaws. These holes do not materially weaken the wrench, and if the discs are held on by bolts, they may be removed if it is desired to employ the wrench for its legitimate purpose.

Suggestions for the Home Painter.—When engaged on outside work, the painter often finds it necessary to hang his paint can from the rung of a ladder. This may be easily done by bending up a simple hook of "S" shape of about $\frac{3}{16}$" cold rolled steel rod as shown at Fig. 27, A. Another simple device, easily made of the same material, and also illustrated, is a piece of wire, having hooks on each end to engage the sides, that will fit across the pail. It will be observed that the brush may be laid on this support, which eliminates placing it at some point where it might accumulate dirt when it is desired to move the ladder from point to point. Another advantage of this wire is that it may be used for wiping off surplus paint from the brush.

Simple Paint Brush Wiper.—Another idea for keeping the outside of the bucket clear of paint is shown at Fig. 27, B. If practice is made of wiping a brush off against the sides of the can, while most

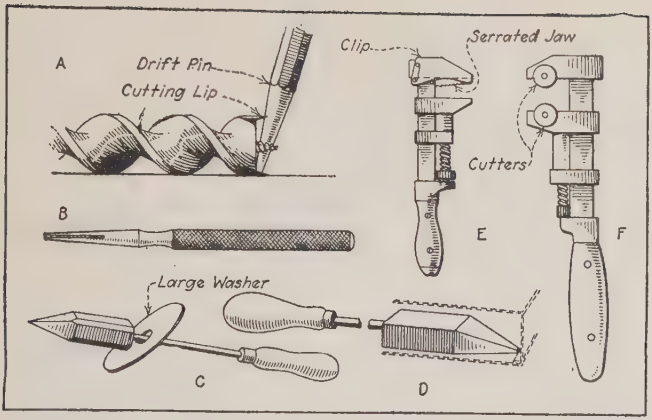

FIG. 26.—A, HOW TO REPAIR WOOD BIT. B, SCREW-HOLDER. C, KEEPING HOT SOLDERING IRON AWAY FROM BENCH TOP. D, SPECIAL SHAPE IRON FOR FLAT WORK. E, JAW TO MAKE PIPE WRENCH OUT OF MONKEY WRENCH. F, CONVERTING WRENCH TO PIPE-CUTTER.

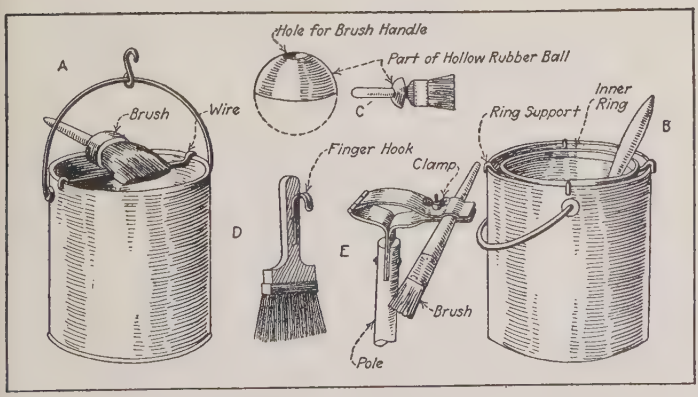

FIG. 27.—HINTS FOR THE HOME PAINTER.

of the paint flows down on the inside, a certain amount always runs down on the outside. This makes a very dirty can. The paint brush drainer shown is extremely simple, consisting of a piece of sheet metal bent in the form of a circle about $1\frac{1}{2}''$ smaller in diameter than the opening of the pail. Hooks of steel wire are made and attached to the ring by solder. These serve to support the ring and locate it concentrically with the outside of the pail. All the paint drained off the brush will fall into the can, and the outside will be kept clean.

Keeping Brush Handles Clean.—When painting overhead, it is hard for the unpractised mechanic to use just such quantities of paint as are necessary, and any surplus is apt to run down on the paint brush handle and to the hand holding the brush. The idea shown at Fig. 27, C, will prevent this. An ordinary hollow rubber ball is cut in half and a hole is made to receive the paint brush handle. The hole should be made smaller than the handle, so that the rubber will tighten around that part of the brush and keep the half-ball firmly in place. When this is fitted, any paint that would tend to run down on the handle will collect in the cup formed by the semi-spherical rubber member.

Handle Hook.—A simple hook that can be attached to a paint brush handle, so that the brush can be hung to the side of the paint pail, is outlined at Fig. 27, D. This wire hook also provides a good hand hold and keeps the brush from slipping out of the grasp. A piece of wire about $\frac{1}{8}''$ in diameter

is bent to the shape indicated, and the ends may be pointed and driven into the wood, or holes may be drilled through the brush handle, the wire ends pushed through and bent over on the opposite side to keep the hook in place. When a hook of this kind is fitted, the brush is held in the usual manner and is braced by passing the hook between two of the fingers.

Extension Handle for Brush.—When it is desired to do a little touching up at points that cannot be conveniently reached even with a ladder, a simple extension fitting may be made out of an old bicycle lamp bracket for grasping the handle of the paint brush. An old broom handle or similar stick may be slotted at one end to receive a portion of the clamp, which is held in place by a small bolt passing through the assembly. As will be apparent even if an old lamp bracket is not available, the clamp member may be easily made by bending up sheet brass or other metal to the approximate form shown. The advantage of this fitting over the usual method of tying the handle of the brush on the end of a stick is that it is much easier to change paint brushes if different colours are to be applied, and the brush is held firmly, which is necessary to secure good work.

CHAPTER III

USEFUL HOME APPLIANCES

Keeping Ladder from Slipping—Practical Ladder Extension—Easy Rest for Feet—Metal Scaffold Bracket—An Intermediate Ladder Step—Using One Lock for Three Drawers—Double Bolt for Door—Secure Locking Means—Furnace Door Opener—Furnace Door Stop—Automatic Draft Opening Means—Broom Hanger—Skirt or Trousers Hanger—Easily Made Door Spring—An Economical Door Stop—Useful Kitchen Appliances—Easily Made Pan Cover—Holder for Milk Bottles—Drinking-glass Holders—Keeping Spoon Out of Kettle—Home Water Works—Garden Hose Repair—Keeping Hose-packing Washers in Place—Repairing Leaky Tap—Home-made Hose Reel—Useful Hand Trucks—Package Carrier for Bicycles—Picture-frame Hanging Made Easy—Metal Corners from Tubing—How to Fasten Floor Boards—Making Wood Screws Tight—Raising a Sagging Door—Efficient Cord-cutter—Locating Drain Pan—Preventing Splash of Waste Water—Cleaning Dirt Out of Corners—Combined Broom and Ice Pick—Sleeve-pressing Board—Ironing-board Support—Shoe-polishing Stand—Indoor Clothes Hanger—Improving Linen Closets—Storing Kettles and Pans—Trouser Hanger for Closet—Installing Curtain Pole—Using Electric Flat Iron for Stove—Range Boiler Repairs—Cheap Candle Lamp—Keeping Soot in Stove-pipe—Clipping Trees without a Ladder—Doubling Capacity of Spring Balance—Simple Magazine Rack—Cabinet for Wood-working tools.

The home mechanic prides himself in being able to make many appliances and devices that will make housekeeping easier, or that will make the many necessary tasks about the home less difficult. The appliances described in this chapter range from

simple devices that may be bent up out of a few inches of wire in a few minutes, to examples of cabinet or joiner work that will furnish occupation for a number of spare hours. All of the suggestions given are adapted to the home and shop, and should be of value for that reason. The handy man who cannot apply many of the suggestions given will indeed be hard to suit.

Keeping Ladder from Slipping.—Serious accidents often result when the bottom of a ladder of the ordinary type slips on the ground or floor, due to being placed at too gradual an angle. A simple method of eliminating this, when the ladder is used on smooth floors of either wood or other material, is to employ a combination pad at the foot of each ladder side as indicated at Fig. 28, A. This combines a sharp pointed spike and a rubber pad, so that it will hold on a large variety of floor surfaces. The retaining fitting for the ladder foot is easily made by taking a piece of band iron and bending it up to the shape shown in the illustration, so that it forms one member of a substantial hinge. It is then securely fastened to the bottom of the ladder by means of wood screws.

The foot pad is provided with two band iron lugs, having a hole through them so that a bolt can be inserted to keep the ladder foot in position, which are attached to the wood blocks by suitable screws. The spikes may be made by screwing the proper size wood screws into the wood from the top, so they will project through the bottom the required distance.

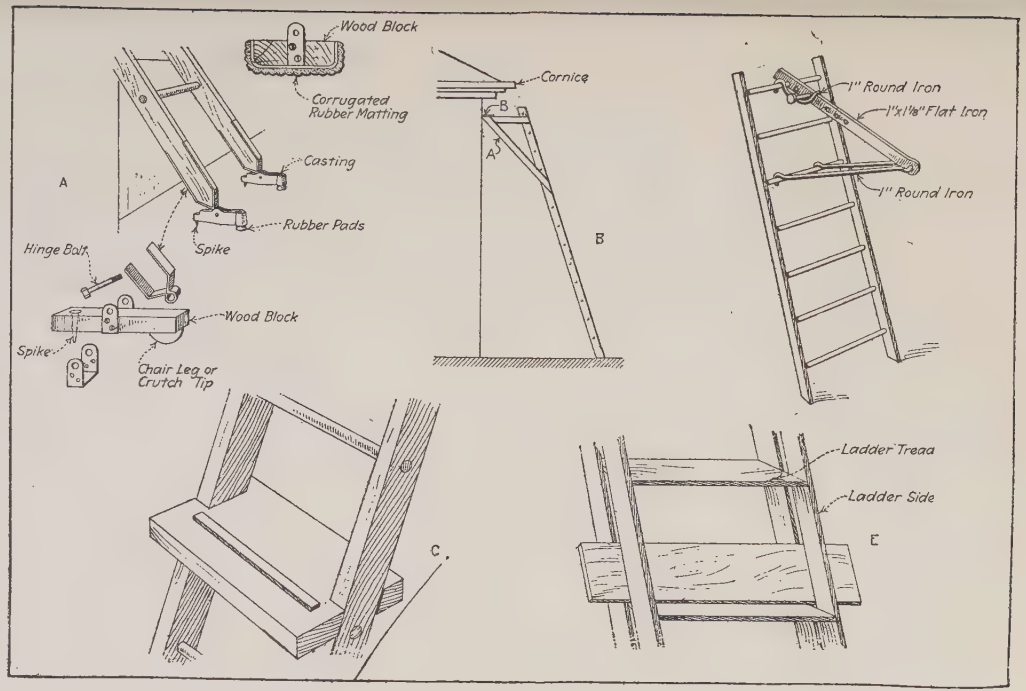

FIG. 28.—SUGGESTIONS FOR USERS OF LADDERS IN THE HOME OR SHOP.

The rubber pad may be extemporized from old or new rubber heels on heavy ladders, or by using the rubber knobs that may be obtained at a hardware store, and that are intended for use on chair legs or as crutch tips. If the ladder is a light one, one wood screw and chair leg tip will be enough. If it is a heavy ladder, it may be necessary to use a series of 4 or 5 screws and 2 or 3 rubber pads in each foot block.

When a ladder is to be used on polished floors where the spike method would result in damaging the polished surfaces, the bottom of the wood block may be covered with a piece of corrugated rubber matting. It will be evident that the hinge method of retention permits the pad to accommodate itself to various angles of inclination of the ladder, or to differences in footing where the ladder is used. Such a device may be easily made by the handy man, and will prove of considerable value as an accessory to any ladder used around the shop or home.

Practical Ladder Extension.—A ladder is sometimes too short to reach over a cornice, in which case it is possible to provide an extension, as shown at Fig. 28, B, so that the roof may be reached even with a short ladder. The extension pieces are made of $\frac{7}{8}''$ stock, and of the proper length to form the V-brace member desired. One of these is securely nailed to each side of the ladder, and a cross-brace is nailed at the other end to keep them from spreading.

Easy Rest for Feet.—When one is not used to

standing on the round rungs of a ladder for a long time, as is sometimes necessary in painting, a flat step may be easily made that will provide a much more easy rest for the feet. This may be made as shown at Fig. 28, C. It is formed of a piece of plank $1\frac{1}{2}''$ thick, 8″ or 9″ wide, and as long as the ladder is wide, and then cutting a piece out of it so that the ends will fit the ladder sides. The notches should be cut on an angle, so that the board will be approximately level even when the ladder is inclined. The plank may be readily put in position by sliding it in the rectangular space between the two rungs, one end being near the lower rung and the other near the upper one on the opposite side. By dropping the high end of the step, it will fit against the sides of the ladder snugly. Care should be taken to select a piece of wood for this that is sufficiently thick, so that it will not be split in half by the weight of the person using the ladder. With an arrangement of this kind the plank may be changed from rung to rung as desired.

Metal Scaffold Bracket.—The scaffold bracket shown at Fig. 28, D, is a good suggestion for the workman who has to use ladders in his business. It is made of flat iron bar and bent round iron bar pieces. A series of holes is drilled in the flat piece, so that it may be adjusted for various degrees of inclination or "slant" of the ladder, and the construction is such that the bracket may be used for low work if placed on the inside of the ladder, or for high work if installed on the outside. The

scaffold planks are rested on the 1″ round iron bars. Two inch by $\frac{1}{4}$″ bar stock and $\frac{3}{4}$″ or 1″ round iron bar are the materials used, and the attachment may be made from the sketch at relatively small cost by any blacksmith.

An Intermediate Ladder Step.—It sometimes happens that the spacing of the rungs of a step-ladder are either too high or too low to work comfortably when doing work on a wall or ceiling, such as washing windows or painting. A temporary expedient is to take a piece of board 4″ to 6″ in width, and place it between the two side pieces of the step-ladder as shown at Fig. 28, E.

Using one Lock for Three Drawers.—When it is desired to lock a number of drawers by using one padlock, a very simple method of accomplishing this, such as shown at Fig. 29, A, may be used. The ordinary form of hasp and staple is employed, the hasp being attached to the drawer fronts, while the staples are driven into the side of the cabinet so that the hasp will fit over it. An ordinary cold rolled round rod has a ring formed at one end of approximately the same size as the staple, and is sufficiently long so it will pass through the three staples as shown. A single locking member will serve to keep the rod in place against the lower staple as indicated, and all three drawers are prevented from opening.

Double Bolt for Door.—The double bolt for a door may be easily made by following the suggestions outlined at Fig. 29, B. This makes a method of

locking from the inside that cannot be opened from the outside, and is especially good for doors of storage sheds or stores that are situated in an alley or at the back end where they cannot be

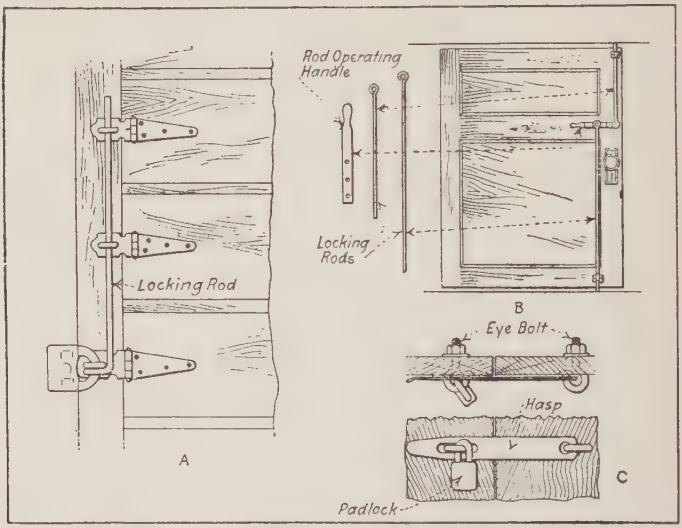

FIG. 29.—METHOD OF LOCKING THREE DRAWERS WITH ONE PADLOCK OUTLINED AT A. B, EASILY-MADE DOUBLE BOLT FOR DOOR. C, SECURE HASP AND PADLOCK FASTENINGS.

easily kept under surveillance. The handle is formed of a piece of flat iron about $1'' \times \frac{1}{8}''$ of suitable length, and has three holes drilled through it about 3″ apart, from one end. Two iron rods are cut so that their aggregate length is about 4″ more than the length of the door. An eye is made in the end of each rod, which is then attached to the handle as indicated by means of bolts or

rivets. A bolt or lag screw is used as a bearing for the handle, this support coming between the two holes to which the locking bolt rods are attached.

The lower ends of the rod are guided by band iron clips attached to the door by substantial screws. If the door is a high one, it may be necessary to guide the locking bolts at an intermediate point as well as the bottom, but this will not be needed ordinarily. Holes to receive the bolts are drilled in the door frame at the top and bottom if the construction permits, and it is well to protect the wood around the holes with metal plates screwed to the frame, and having a hole in the middle to register with that bored into the door frame. On some other constructions it may not be possible to provide this system of anchoring the bolt rod ends. In such cases, a simple angle bracket that may be fastened above the door will serve as a receptacle for the bolt end. No difficulty will be experienced with the bottom bolt, because it will always be possible to make a hole in the door jamb or floor.

A Secure Locking Means.—When staples are used in connection with the ordinary hasp method of locking, the door may be opened by anyone who is sufficiently intelligent to use a claw hammer or pry bar to pull the staple out of the wood. A much more secure method is outlined at Fig. 29, C, in which U-bolts are used having a long leg and a short leg. The long leg is threaded while

the short leg is not. The long leg is passed through a hole which goes entirely through the board in the door and at the side of it, while the short one goes only part-way into the wood. If desired the short leg may be pointed, so that as the nut is tightened against the washer, the pointed prong will be drawn firmly into the wood. In appearance the U-bolts look just like the staples, but as will be evident, they cannot be pulled out without destroying the piece to which they are attached.

Furnace Door Opener.—The handy man who has to shovel his own coal in the furnace often finds it uncomfortable to open the hot door by hand, and when approaching the furnace with a shovel full of coal, it is necessary to rest the load on the floor, with the danger of spilling part of the coal, while the door is opened, or keeping the door open during the stoking operation, which results in a material loss of heat due to cooling the fire. A very simple arrangement composed of a piece of wire rope passing over the pulley screwed into one of the ceiling joists, one end of which is attached to a hinged board as indicated at Fig. 30, A, provides a method of opening the door by foot-power. The wire rope should have sufficient slack in it so that the fire box door can be swung open to its full opening. The pulley screwed into the ceiling is placed a little in front of the door instead of directly over it. Any form of hinge may be used to attach the pedal board to the floor.

Furnace Door Stop.—When valves or other

fittings are carried on a pipe that runs close to the furnace, which may be hit by a swinging furnace door, it is possible to damage these by the door bumping against them if it is not carefully opened. A simple method of preventing this trouble, and also one that keeps the door from swinging too far, is to use a triangular piece made of band iron which swings from the hinge rod of the furnace door. The method of application is clearly shown at Fig. 30, B.

Automatic Draught Opening Means.—A number of devices have been made, some operating on electrical principles, and others on mechanical systems, that will permit opening the furnace draught door any given time. The arrangement shown at Fig. 30, C, outlines a combination of levers, pulleys, and weights, and may be set in motion by an ordinary alarm clock so that the furnace draught door may be opened automatically by the clock. The door is raised by a cord or a chain which may be operated by two methods. One is a leverage mechanism, the other is a cord which passes through the floor and into one of the upper rooms. The automatic operating mechanism is very simple, though it looks complicated. A trip lever is held from the ceiling joists by a simple A-frame made of wood, and is held in a vertical position, when the door is closed, by a latch member. The end of the latch member is provided with a simple trigger of bent iron, while the long end of the trip lever is attached to a spool, which is fastened to the winding key which is employed to wind the

clock alarm spring by the medium of a cord fastened over a pulley.

As is well known, when the alarm goes off, the winding key turns around. The spool is attached to the key by sawing a slit across the top of the spool and then glueing it to the key. The alarm is set to go off at the desired time one wishes to have the draught open, and when the spool turns it acts as a windlass and winds the cord on it that is attached to the trip lever, which pulls the long end up and allows the short end to which the trigger is fastened to drop down. This releases the vertical lever and allows the weight to drop down, and raise the furnace draught door by means of a cord or chain attached to this member, and which passes over suitable pulleys, so that the downward motion of the falling weight is changed to a vertical or upward motion of the draught door and so opens it.

Simple Broom Hanger.—A piece of brass or iron wire or rod $\frac{3}{16}''$ or $\frac{1}{4}''$ in diameter bent to the form shown at Fig. 31, A, and attached to the wall with a couple of screw eyes, forms a very good holder for a broom handle. A short bend is made on one end of the straight part, so that the hook will be held out from the wall far enough to make it an easy matter to place the broom handle in the hook. The weight of the broom keeps it in position.

Skirt or Trousers Hanger.—An economical hanger for skirts and trousers may be made as indicated at Fig. 31, B. In this, two ordinary metal spring clamp clothes-pins are attached to each end of a

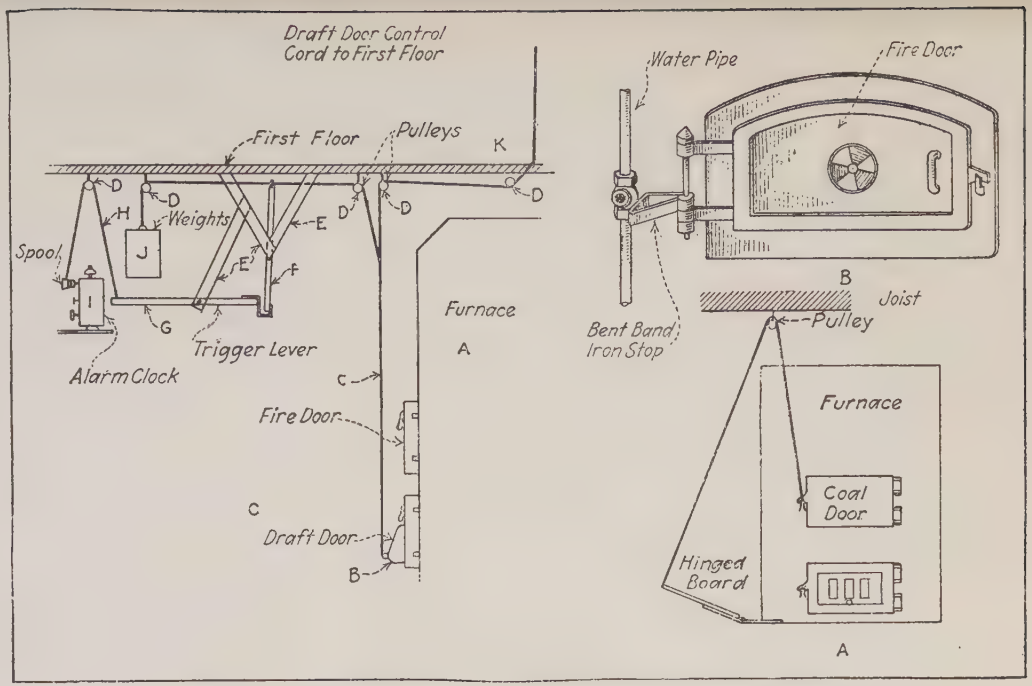

FIG. 30.—SUGGESTIONS TO MAKE FURNACE OPERATION EASIER.

looped galvanized iron wire $\frac{1}{8}''$ in diameter. The clothes-pins are fastened one at each end of the wire and about 8″ apart. As the attaching method consists of fastening the wire through the hinge of the spring clamp, no difficulty is experienced in sliding the clothes-pins to adapt these to hold pieces of varying widths.

Easily-made Door Spring.—An effective and simple spring for screen doors or storm doors may be bent up by the home mechanic from spring steel wire about $\frac{1}{8}''$ in diameter. In order to turn the eye and make a neat job, the wire should be heated, and while red hot should be bent around a piece of wood such as a broom handle or an iron pipe. After the bend is made, the spring may be hardened by heating to a red heat and quenching it in oil. The upturned ends of the spring are attached to the door and the door frame by substantial staples. Two of these springs will be suitable for any kind of light door, one placed near the top and the other near the bottom. For a heavier door it may be necessary to use from 3 to 6 springs.

An Economical Door Stop.—A simple door stop that will not mar the door or the floor may be bent up from a piece of steel or brass wire as shown at Fig. 31, D. This is bent up as shown in the illustration, which also clearly outlines this use. The upwardly bent hook is provided with a step which goes under the door, and the back of which acts as a stop to keep it from sliding too far under the door. As there is considerable spring to the

bent wire hook, it is merely necessary to push the device in place with the foot to lock the door open in any desired portion of its swing.

An effective door stop can be made of a piece

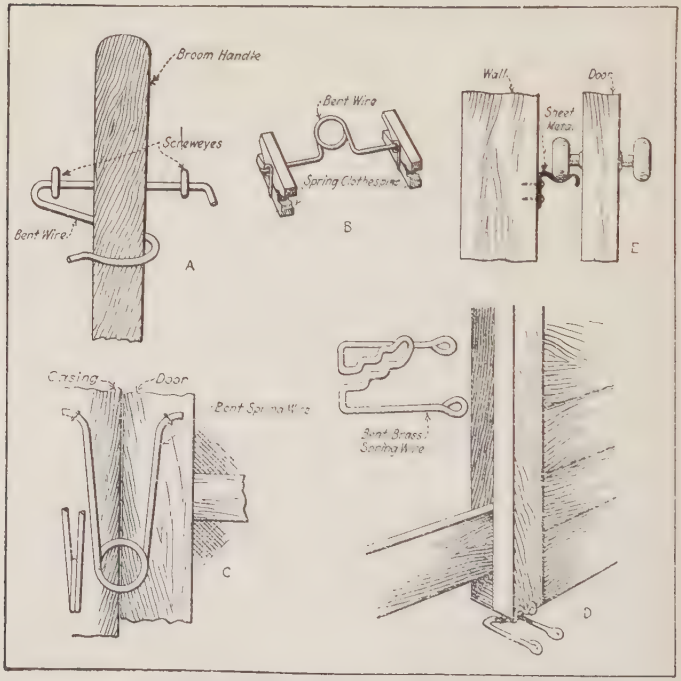

FIG. 31.—SIMPLE BENT WIRE DEVICES FOR THE HOME.

of sheet metal such as spring brass which is bent up as shown at Fig. 31, E, and which will keep the door from swinging against the wall and the door knobs marring the plaster. The bent end is formed so that the door knob will ride over it and

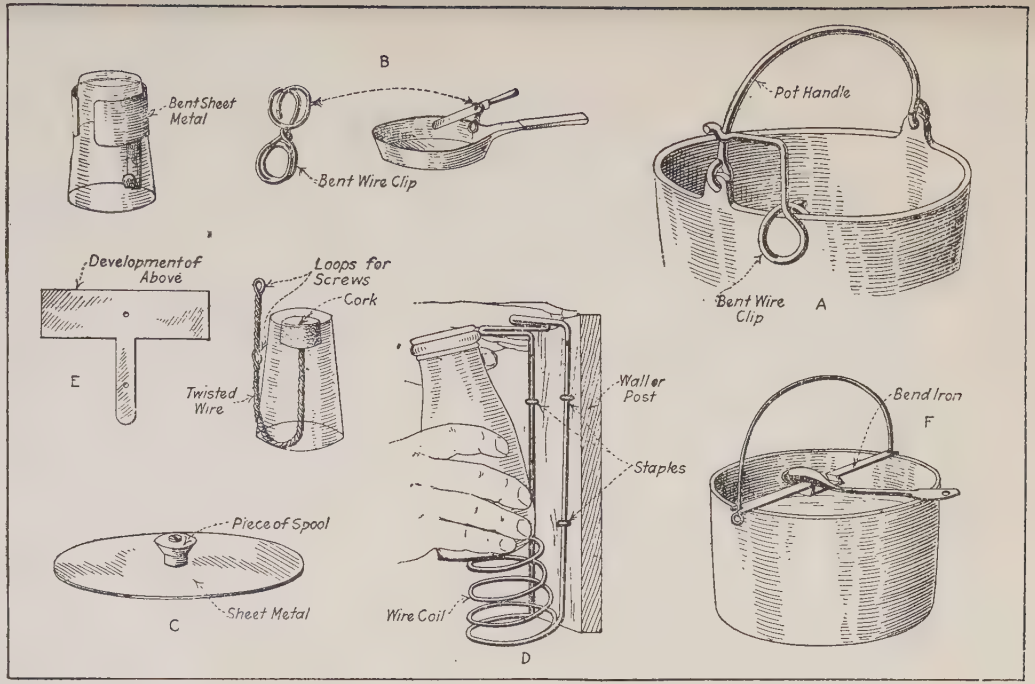

FIG. 32.—SUGGESTIONS FOR APPLIANCES IN WIRE AND SHEET METAL TO HELP THE HOUSEWIFE.

fit into the groove provided for its reception. It is attached to the wall by wood screws, as is clearly indicated.

Useful Kitchen Appliances.—Some useful appliances that may be made by the handy man to assist the housewife in the kitchen work are shown at Fig. 32. There is nothing so annoying in cooking as to have to grasp a hot kettle handle which has become heated from resting against the side of the kettle. If the handle is supported in a vertical position, it is evident that it will be kept cool enough so that it will be grasped without discomfort. A simple appliance made of spring wire, bent up with a hook at one end to hold up the handle, and a clip at the other end by which it may be attached to the side of the kettle, will do its work in an effective manner.

Another simple wire fitting that may be easily bent up, and that will be found very useful, is in a form of the double clip such as shown at Fig. 32, B. This clip can be made of brass wire, and will hold a knife to a frying-pan, so that it is not necessary to place the utensil on a table or stove when frying anything in the pan that needs frequent turning over.

Easily Made Pan Cover.—It often happens that the knobs attached to pot covers become lost, or that a cover must be extemporized in an emergency to replace one that has become damaged or misplaced. A scheme outlined at Fig. 32, C, shows how an ordinary spool may be used as a handle by cutting it in half and fastening it in place by a small

bolt and nut, or by using a rivet of the proper size. An emergency cover that will fit a variety of sizes of kettles can be made in this manner by taking a pie pan and attaching a spool in the centre to act as a handle.

Holder for Milk Bottles.—A bent wire holder for milk bottles, such as shown at Fig. 32, D, may be made and attached to the sides of the door by means of staples, and will prove very useful in keeping the milk bottle off the stairs or porch, where it may be knocked over by cats or dogs, or taken by irresponsible children. The wire is bent so that one end of it forms a spring that is used to provide a support for the milk bottle bottom, and hold it firmly in place in the pair of looped arms at the top which encircle the neck of the bottle. Such a holder will be of benefit to both the delivery man and the housewife, in that it will save stooping, as it can be attached sufficiently high on the wall or door frame so it can be reached easily without bending.

Drinking-glass Holders.—Two forms of drinking-glass holders, which may be easily made by the handy man, are shown at Fig. 32, E. One of these is made by twisting wire so that a loop is provided at two points, in which screws may be inserted by which it is attached to the wall, while a large cork on the upturned hook end is a good support for the glass. The other holder is bent up of sheet metal, and is also attached to the wall by wood screws. As the fitting is shown both in the development or pattern form, and its appearance as bent up, no

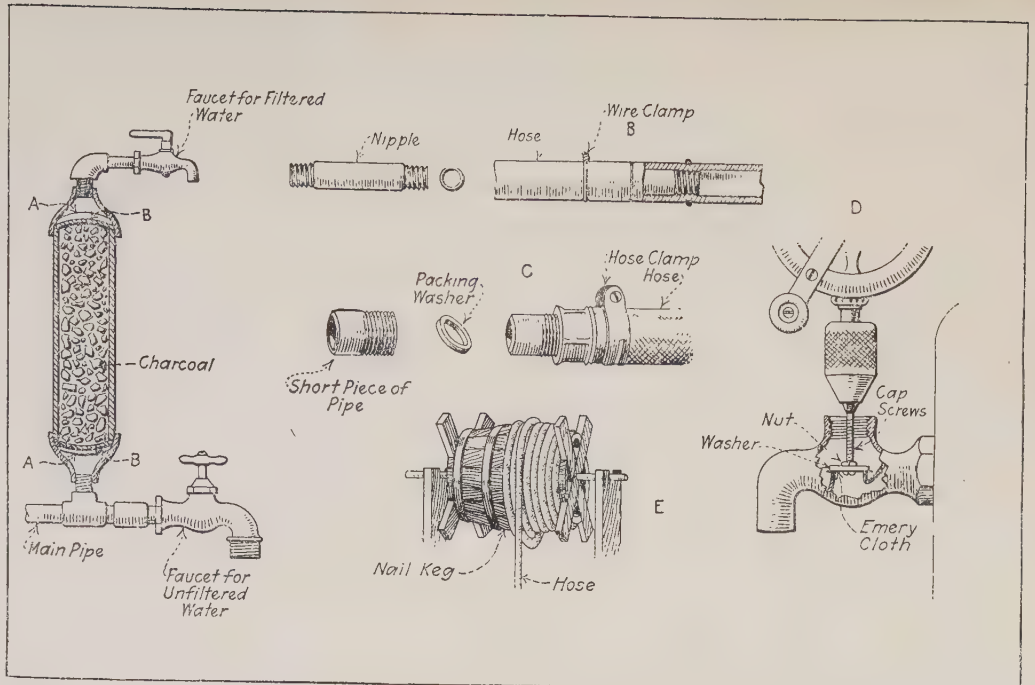

FIG. 33.—THE HOME MECHINIC CAN EASILY MAKE THE EFFECTIVE WATER FILTER SHOWN AT A, AND CAN ALSO MAKE USE OF THE OTHER SUGGESTIONS.

difficulty should be experienced in making it. A piece of sheet brass is the best material for constructing this holder, as it may be kept brightly polished and cleaned, while tinned iron would be apt to rust.

Keeping Spoon out of Kettle.—A spoon rest for kettles, shown at Fig. 32, F, is usually made by taking a strip of light sheet metal or band iron, cutting a notch at one end that will spring into the kettle handle, and having a depression in the centre to hold the bowl of the spoon. In cooking certain materials where frequent stirring is necessary, the support indicated is valuable, because the spoon is kept in an accessible position, and any material in the bowl will drain back into the kettle.

Home Water Works.—In some cities the drinking water is apt to contain a variety of substances in solution that make it necessary to filter it when it is used for drinking, and yet it is good enough to use in its original condition for washing purposes. By using pipe fittings, the home mechanic may easily make a filter that will be cheap and effective. This is shown at Fig. 33, A. A T is placed in the main line just back of the tap, and this holds a reducing coupling which supports a piece of 1½″ or 2″ pipe about 6″ to 8″ long. Another reducing coupling of the proper size is placed on the upper end, to which a small tap is attached by means of a couple of nipples and an elbow. Felt or filter-paper backed with wire gauze is used at both top and bottom of the pipe to hold the filtering material,

which is charcoal, in place. When drinking-water is required, it may be drawn through the small faucet and filtered, whereas water for other purposes, where cleanliness and absolute purity is not essential, may be drawn directly from the mains. This is a big advantage over the usual form of small household filter, in which all water used, regardless of the purpose for which it is intended, must pass through a small filter fitting that contains but little screening material.

Garden Hose Repair.—Whenever a leaky spot occurs in the garden hose, it is possible to make a good emergency repair that may be kept as a permanent one if desired, as shown at Fig. 33, B. A ½″ pipe nipple about 4″ or 5″ long, with threads turned on the ends, is inserted to couple the two ends of the hose together after the defective portion has been cut out. The nipple is held securely in place by twisting several pieces of hay wire tightly around the hose over the threaded portion, which causes the rubber to jam in between the threads and make a tight joint. Ordinary hose clamps may be used for this purpose, and will be found considerably more effective than the simple wire, for if these are used it is not necessary to have a threaded nipple, but any short piece of pipe will answer for the coupling that will withstand high water-pressure.

Keeping Hose-packing Washers in Place.—In taking a hose off the bib cock, or when removing a nozzle from the end of the hose, it is not unusual to lose the rubber or leather packing washer that

makes a tight joint at the coupling. The device shown at Fig. 33, C, which consists of putting a short piece of pipe in the coupling to hold the washer in place, is one that will save considerable annoyance when the hose is used again.

Repairing Leaky Tap.—The ordinary faucet will often leak, even after new washers have been inserted on the valve. This is because particles of sand or grit have roughened the valve seat, and the washer will not fit correctly on the irregular surfaces. A method of refacing the valve seat that is very effective, and that can be easily done by the home mechanic, is shown at Fig. 33, D. In this a suitable screw, such as a stove bolt $2\frac{1}{2}''$ or $3''$ long, and a couple of iron washers of the proper size to fit the spigot seat, are used in the manner indicated. A piece of emery-cloth is cut larger in diameter than the valve seat. A hole is punched in the centre, through which a screw is passed. If the small washer that is placed under the screw head is sufficiently small in diameter to fit inside of the valve seat when used, the emery-cloth will be clamped more tightly against the larger washer. The nut of the stove bolt is then screwed down firmly against the top of the large washer to bring the various parts of the assembly tightly together.

By grasping the end of the bolt in the chuck of the hand drill, it will be possible to grind down the face of the valve seat without much trouble. Needless to say, the water-supply must be turned off before the valve and its packing nut are removed

from the opposite body. The drill press should be held firmly, and if the abrasive paper is turned at a moderate speed, the valve seat will be ground smooth. If the valve seat is grooved badly, it will be well to start the operation by using the coarse emery-cloth, then finishing with finer abrasive.

Home-made Hose Reel.—One of the common causes of garden hose depreciation is because the hose is carelessly stored away, usually in a hopeless mass of kinked and twisted convolutions. When a hose reel is not available, the home worker may extemporize one easily by using a nail keg and cross-arms made of $\frac{7}{8}'' \times 2''$ boards. An iron rod, wooden broom handle, or an iron pipe may be used as an axle, and is passed through the centre of the cross-arms and head to act as a bearing. The hose may be easily and quickly coiled over this keg to keep it from being damaged, and also to have turns of sufficiently large curvature so the inner walls of the hose will not be injured by bending at too sharp angles.

Useful Hand Trucks.—For handling trunks, heavy boxes, ash cans, and other objects of that nature, a hand truck is a very useful thing to have around the house. There is not sufficient use in the ordinary household for a device of this character to warrant the purchase of a warehouse truck, but it is not difficult to make a very satisfactory hand truck from a discarded lawn mower. The form shown at A, Fig. 34, outlines practically all of the mower parts except the knife-blades and the roller. After the

rotary cutting-knives are removed and the knife-blade is taken off the outer bar, the mower is turned over and a piece of board is attached to the cutter bar, which forms a substantial platform. A piece of band iron is then bent to form a supporting leg,

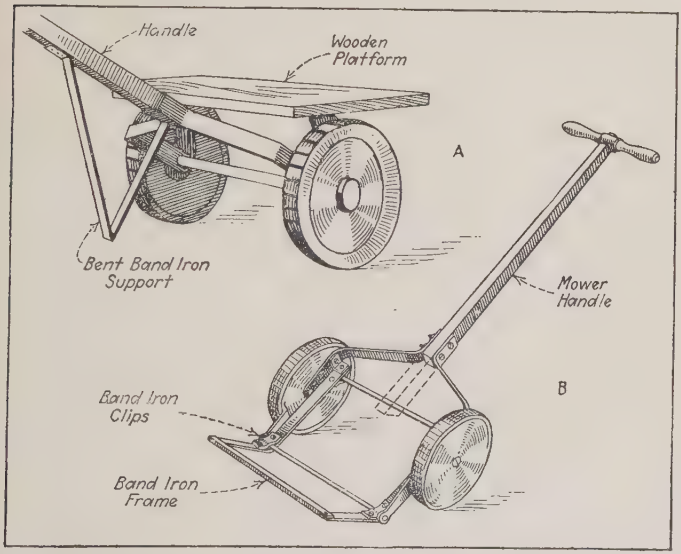

FIG. 34.—HOW TO CONVERT WORN-OUT LAWN MOWERS TO SATISFACTORY TRUCKS FOR HANDLING BOXES AND BARRELS.

that is attached to the lawn mower handle by bolts as indicated.

In the form shown at B, the roller and cutting-knives are removed, as is the gearing from the interior of the wheels. The latter may then revolve on their axle without having any connection with the cutter shaft. An iron framework is bent up

from bar iron of suitable size, and is held in place by easily-made clamps and angle pieces, which are also bent from strip band iron and securely attached to the iron frame by suitable bolts. The arms that formerly supported the roller are now used to hold the brace rod that acts as a support for the lower portion of the bent iron frame. The construction is such that the truck may be as easily placed under a barrel or crate as the usual form of warehouse truck is. The truck may be made considerably stronger by extending the lawn mower handle as indicated by the dotted lines, so that it may be attached to the rear brace rod by suitable clamps.

Package Carrier for Bicycles.—A simple and easily made accessory that will increase the usefulness of a bicycle can be readily contrived by the home mechanic, out of odds and ends, that will perform the work just as well as any luggage carrier purchased from the usual sources. The manner in which an old bicycle fork, which can be secured from an old bicycle frame or from any junk shop, may be employed as a substantial support for the carrier board is shown at Fig. 35. All that is necessary to use the fork as a support is to cut off the tube that projects into the steering head so that it will only be about $1\frac{1}{2}''$ long. The hole in the fork end may have to be drilled out, as the usual size bicycle front axle is $\frac{5}{16}''$, while the axle of the rear hub is generally $\frac{3}{8}''$ in diameter. The carrier is made of any piece of $\frac{7}{8}''$ stock that happens to be available, and a hole is bored in this to permit

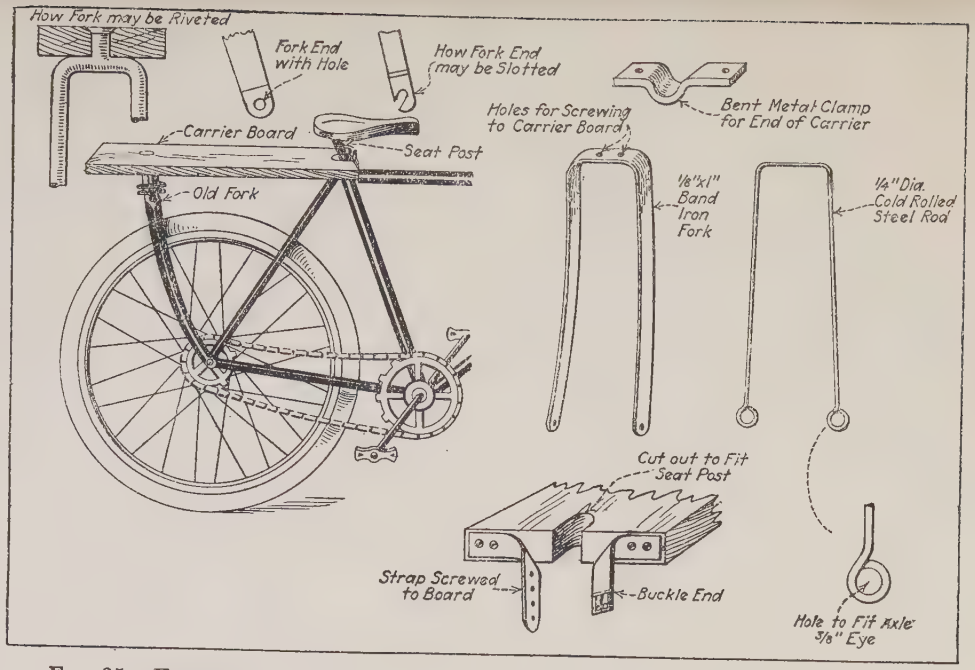
How Fork may be Riveted
Fork End with Hole
How Fork End may be Slotted
Bent Metal Clamp for End of Carrier
Holes for Screwing to Carrier Board
Carrier Board
Seat Post
Old Fork
1/8"x1" Band Iron Fork
1/4" Dia. Cold Rolled Steel Rod
Cut out to Fit Seat Post
Strap Screwed to Board
Buckle End
Hole to Fit Axle 3/8" Eye

FIG. 35.—EASILY-MADE AND INEXPENSIVE PARCEL CARRIERS FOR USE ON BICYCLES.

the tube above the fork crown to enter into it, and as this has been cut $1\frac{1}{8}''$ long, it should project $\frac{1}{4}''$ above the face of the board. The top edges of the hole are chamfered, and the edge of the tube projecting through it is flattened over outwards so that the board is securely held against the fork crown.

A notch is cut in the front end of the board to fit around the seat post, and the board may be held in place by either a leather or a metal strap. To fit the device to the bicycle, the nuts are removed from the ends of the rear wheel axle and the fork ends are sprung over the projecting axle, or, if the fork has slotted ends, as are sometimes found on front forks, these may be pushed right in place after the locking nuts are backed off without spreading the fork as much as will be necessary if holes and not slots are used. It may simplify matters and make installation easier if the fork ends are slotted by cutting out the metal at one side of the hole with a hacksaw.

If an old bicycle fork is not available, it is easy to make a brace that will support the board by either of the schemes shown at B, Fig. 35. In one case, the support may be made by bending up an $\frac{1}{8}'' \times 1''$ band iron, and drilling holes at the top so it may be fastened to the carrier board by screws or bolts, and providing drilled or slotted ends to fit the rear hub axle. The other system is to take a piece of $\frac{1}{4}''$ or $\frac{5}{16}''$ diameter cold rolled rod, bend up the eye at each end and then bend it in the form of an elongated U member that

may be attached to a carrier board by staples. In order not to take up too much room on the hub axle, the eyes should be flattened so they are no more than $\frac{1}{8}''$ thick. A number of modifications of the carrier shown may be carried out to suit the pleasure of the person making it. A light metal rack may be made by bending up band iron strips and riveting them together to form a basket, or by attaching to the board a woven wire basket that may be obtained from a hardware store and which is sold for parcel-carrying purposes.

Picture-frame Hanging Made Easy.—It is surprising what a number of useful appliances, that will greatly simplify the work about the home, may be made by the use of odds and ends of materials and the exercise of a little ingenuity. The picture-frame hanger shown at Fig. 36, A, is a good example of how a very simple fixture will make a hard job easy. The first step is to form a holder for the hook that fits over the moulding, which is made of spring brass or strip steel by using the hook as a guiding pattern. This is attached to the top of the pole, which is notched out to receive it, by a wood screw. The picture cord is passed over the hook, which is then inserted in the holder as shown in the illustration, and the hook may be easily placed over the moulding without standing on a chair or stretching to reach the moulding. After the picture is in place, it is not difficult to remove the holder from the hook by simply rocking it off by working the bottom of the pole.

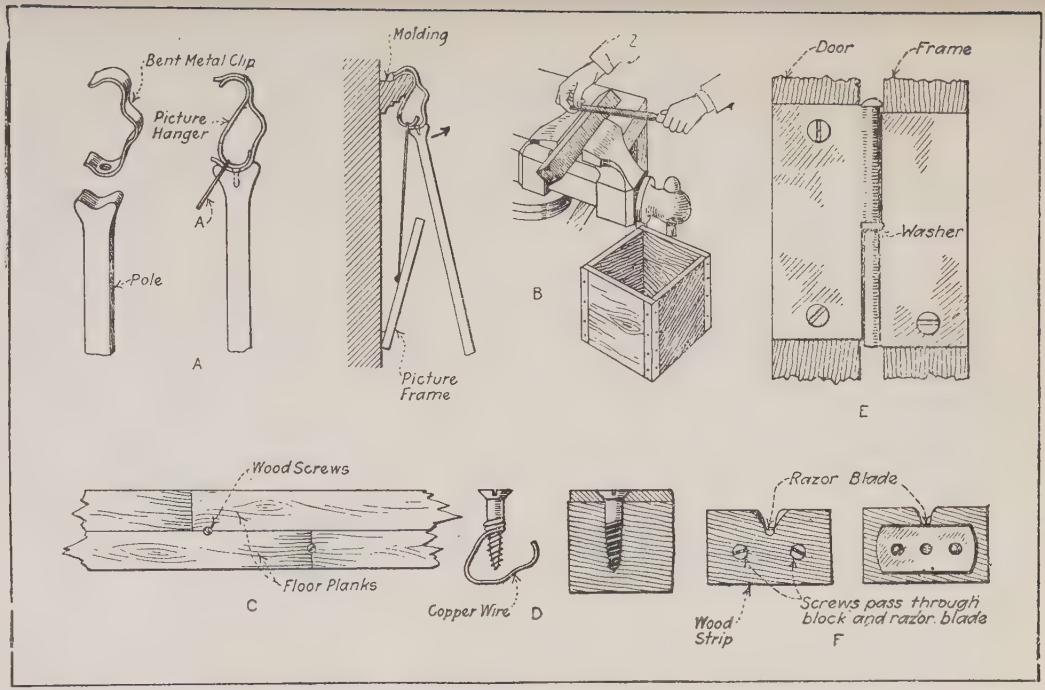

FIG. 36.—A VARIETY OF USEFUL SUGGESTIONS TO HELP THE HOME MECHANIC IN HIS WORK.

Metal Corners from Tubing.—The home mechanic who wishes to put metal corners on a tool box or chest of any kind finds it a considerable job to bend up a piece of sheet metal to form a reinforcement that will have a good sharp bend. A very easy way of obtaining clean-cut metal corners is to secure square section metal tube of the proper size, such as is used in making bedsteads, and cutting off the metal at the opposite corners with a file as shown at Fig. 36, B. When corners at opposite sides are cut off, two angle pieces are left that will form a very satisfactory reinforcement, after holes are drilled or punched through to receive the nails or screws by which they are to be fastened to the box corner.

Fasten Floor Boards.—A simple expedient shown at Fig. 36, C, is a good preventive of squeaking floor boards. The reason these are noisy when stepped upon is that fastenings have loosened due to seasoning or drying out of the wood, which allows the sides of the boards or their edges to rub together. This may be prevented by screwing wood screws of the flat head form in between the cracks, which will either spread the ends apart slightly so that they will not rub, or which will hold the boards securely in place.

Making Wood Screws Tight.—When door hinges or other pieces that cannot be easily changed in position become loose due to the movement of wood screws holding them, these having become loosened in the holes, there are several methods

of remedying the condition. One of them is to drive a wood plug in the enlarged holes and then to replace the screws. Another way is to use a larger screw, which usually calls for drilling out the holes in the hinge, so that the enlarged shank will pass through. The method outlined at Fig. 36, D, which has proved successful in some applications, consists of winding the defective diameter of the threaded part, and really makes an enlarged screw that will be of better fit in the hole.

Raising a Sagging Door.—An easily applied remedy for raising a door that has sagged so that its outer ends rub on the floor, and that does not call for resetting the hinges, is shown at Fig. 36, E. In this, the halves of the hinges are spread apart enough to lift the door by placing two washers between the two portions of the hinge, so that the door is raised slightly. A $\frac{1}{8}$″ washer will often raise the door enough so that the end will not rub on the floor. A washer should be used in both upper and lower hinges. If the door is supported by three hinges, it will not be necessary to use washers in the middle hinge.

Efficient Cord-cutter.—A blade that has done its duty in a safety razor may be used still further by fitting it to a block of wood as shown at Fig. 36, F, which will form a very good string or cord cutter when it is screwed to the end of a counter or a table. A notch is cut in the wood piece so that a portion of the blade sticks up enough to cut the string when it is pressed down into the notch. The

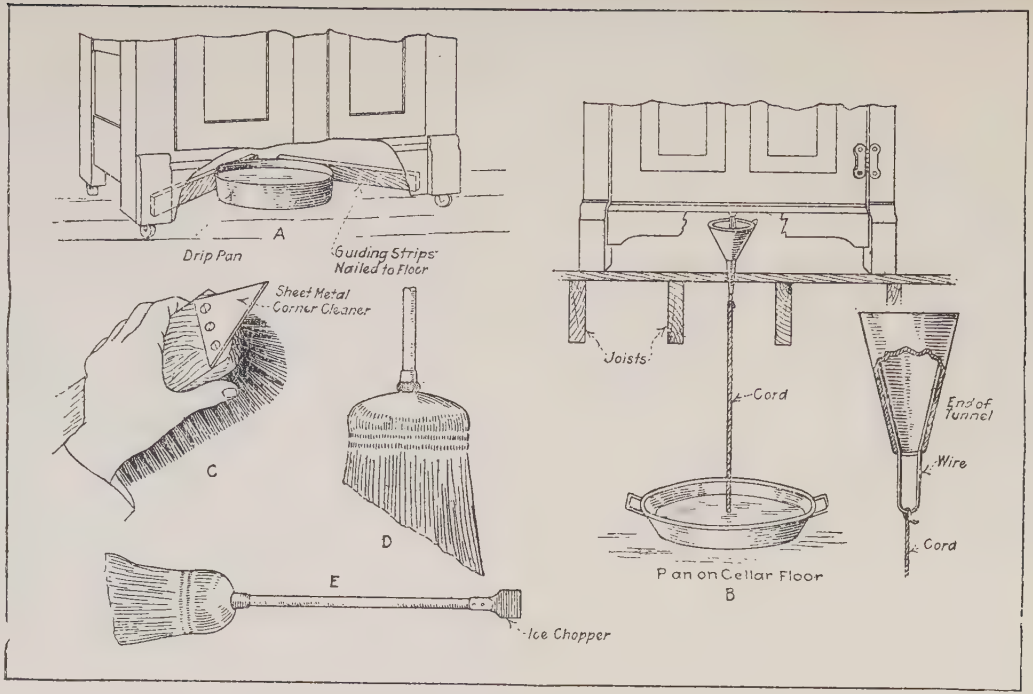

FIG 37.—METHOD OF HANDLING THE ICEBOX DRIPPINGS ARE SHOWN AT A AND B. BRUSH AND BROOM IMPROVEMENT OUTLINED AT C, D, AND E.

blade is held in place by screws which pass through the wooden piece, and when the blade becomes dull, it may be readily removed for sharpening or for inserting a new blade in the holder. The method of construction is so clearly shown that any home mechanic can easily make this useful device.

Locating Drain Pan.—One of the annoying household tasks is emptying a drain pan from under the bottom of the icebox, and replacing it after it is emptied so that it will be properly placed in regard to the icebox drip pipe. The device shown at Fig. 37, A, is a simple method of insuring the location of the waste water receptacle without stooping over and looking under to make sure that it is properly placed under the waste opening. Two cleats or wood pieces are attached to the floor in a V shape under the icebox, with the apex of the V so placed that the pan will be in the centre under the drip pipe if both sides of it are in contact with the guiding strips.

Preventing Splash of Waste Water.—Another method of insuring that the drainage from the icebox will fall into the pan, and not on the floor, is outlined at Fig. 37, B. In this, the water container is carried in the basement, and the waste water is directed through the floor under the refrigerator by a funnel. In some cases, there is no connection between the bottom of the funnel and the pan, and the water must drop 8 or 10 feet. If the pan is set on the floor, the water will splash around and cause an annoying wetted area around the pan

that must be mopped up constantly. There are two methods of making sure that the water will reach the pan without splashing. An obvious one is to connect the bottom of the funnel with the waste water pan by means of a piece of rubber hose. The method shown is a cheap and effective one. A piece of wire is bent to fit the side of the funnel spout, and a piece of string attached to it leads down to the pan. The water will drip down by following the string, and will not splash because of its gradual movement. When the string becomes dirty it may be easily removed.

Cleaning Dirt out of Corners.—It is hard to reach the corners of a room with an ordinary form of floor brush when scrubbing floors, and dirt will collect there and become so hard that it cannot be washed out. The handy man may put a simple attachment on the end of the floor brush handle that will make it possible to clean out the corners thoroughly without having to get up and get an old kitchen knife to do the work. The pointed piece of metal is attached to the handle by wood screws as shown at Fig. 37, C.

Another expedient, when sweeping out corners, is to take a worn straw broom that is no longer useful for ordinary sweeping, and to cut the straws off diagonally as shown at Fig, 37, D, so that the pointed end will go into the smallest corner and remove the dirt collected there. A broom of this kind is especially useful in sweeping boxed-in stairs where there are numerous corners.

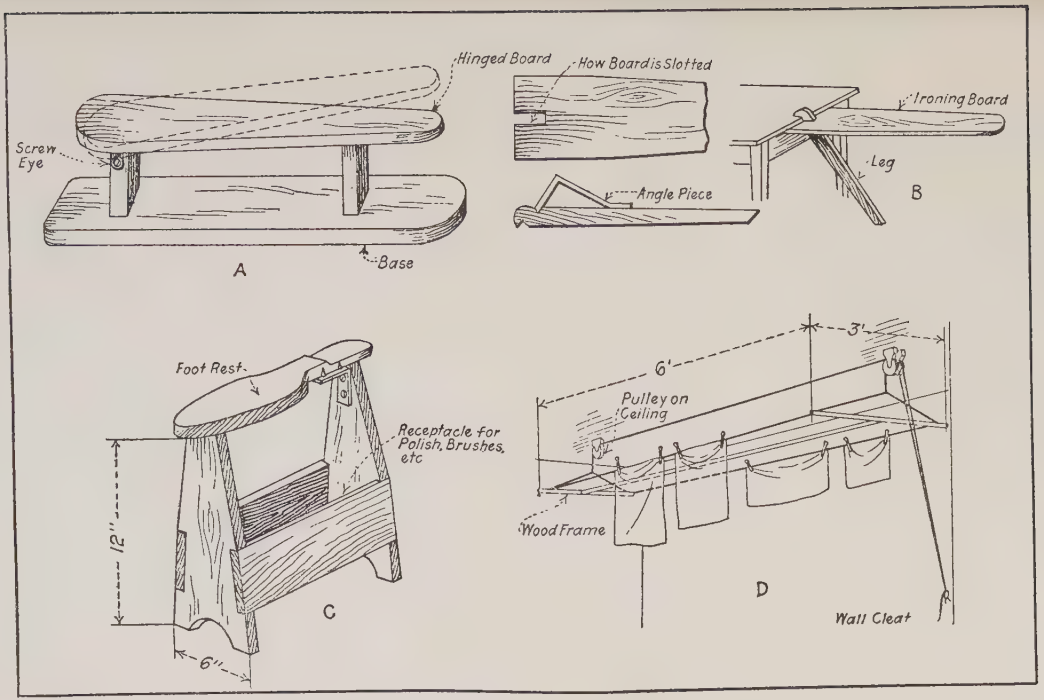

FIG. 38.—MISCELLANEOUS USEFUL HOUSEHOLD APPLIANCES THAT MAY BE MADE BY THE HOME MECHANIC WHO UNDERSTANDS WOOD-WORKING.

Combined Broom and Ice Pick.—The home mechanic will find that, if he adds an ice chipper to a large broom handle as shown at Fig. 37, E, he has a very satisfactory appliance for removing a light fall of snow from paths, and when he encounters a piece of ice, it may be easily chipped by reversing the position of the broom, and then the loosened particles may be swept off by using the other end. Combining the two appliances that must be used together in this way saves space, time, and makes it easier to do the work.

Sleeve-pressing Board.—The handy man who wishes to exercise his wood-working talents can not only increase his knowledge of wood-working, but also make a number of devices and household appliances that have real merit. As an example of what may be done, the sleeve-pressing board at Fig. 38, A, may be constructed. It is composed of a piece of board about 30″ long, 8″ wide, and $\frac{7}{8}$″ thick, to which two standards or short upright pieces are nailed to support the sleeve board, which is cut out of a piece of $\frac{7}{8}$″ stock of the desired shape and size. The sleeve board may be hinged to one of the supporting pieces by using screw eyes, which are screwed into the bottom of the board, and which are guided by screws let into the sides of the standard that supports the big end of the board. It is also possible to use an ordinary form of hinge for this purpose, but if a removable hinge is provided, the boards may be readily taken down if desired.

Ironing-board Support.—The ironing-board support as shown at Fig. 38, B, is also a useful appliance, as it enables one to swing the ordinary form of ironing board from the edge of a kitchen table, and thus secure more supporting surface when ironing large pieces. This support is made of a piece of $1\frac{1}{2}''$ thick board provided with two notches at one end as shown. It is made of proper length, which can best be determined by experiment, so that the ironing board will be held firmly against the projecting table top. A slot is cut into the big end of the ironing board, which has been squared off, wide enough to receive the supporting leg and about 4″ long. This admits the one supporting member to the notch, clamping down one notch cut in it on the table, and the other notch holding the ironing board up as indicated. In order to provide more supporting area for the board, a piece of wood of triangular form may be attached to the leg as an added support, or a piece of band iron bent to the form shown may be secured to the support. It will be found that a supporting leg of this kind will give a very good support to the ironing board, and, as that member is held at only one end, it can be used to special advantage in ironing skirts and dresses, which can be pushed over the open end easily.

Simple Shoe-polishing Stand.—A shoe-polishing stand that will assist materially in keeping the shoes of the members of the household properly cleaned may be made by following the suggestions

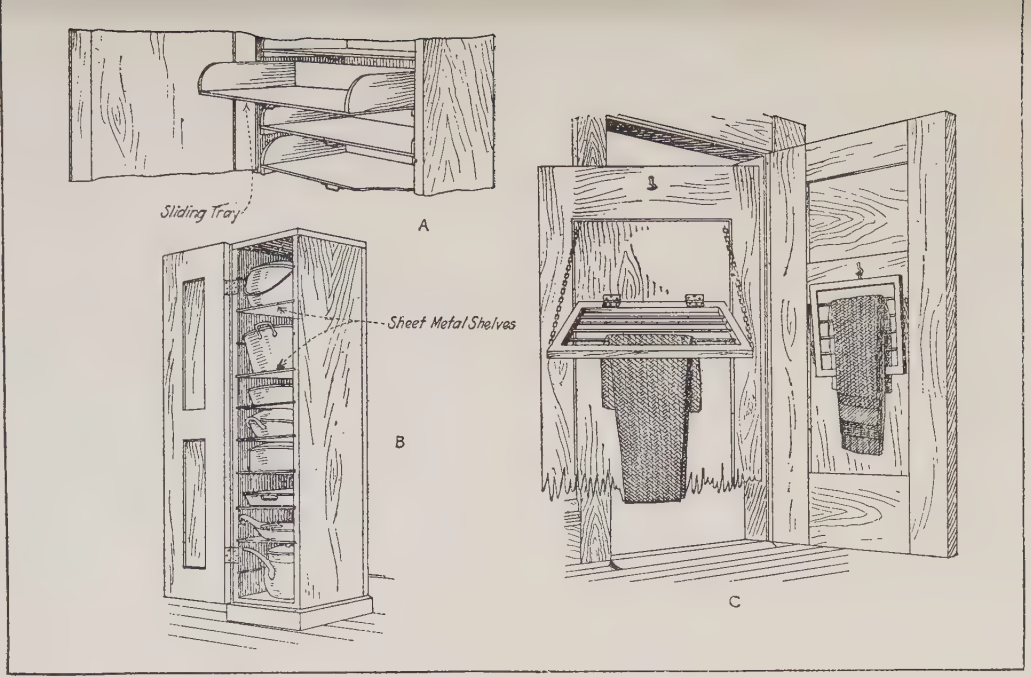

FIG. 39.—SOME IMPROVEMENTS THAT ARE POSSIBLE IN CLOSET CONSTRUCTION.

and illustrations at Fig. 38, C. The ends may be made of $\frac{7}{8}$″ stock and approximately to the dimensions indicated. The side pieces may be made of lighter stock, and the bottom board, which is nailed across the two end pieces and attached to the side pieces to form a box, may be made of any desired materials. The box is very useful for holding polishing cloths, brushes, and polishes. The top piece, which serves to support the foot, is shaped approximately as the sole of the shoe is, and is made of a block of wood about 3″ wide, 9″ long and 2″ thick. It is attached to the upright standards or end pieces by means of angle pieces securely fastened to the block and end pieces by wood screws, or by long wood screws running through the block from the top extending into the side pieces.

Indoor Clothes Hanger.—An overhead clothes hanger, such as shown at Fig. 38, D, is very useful for handling small washings during wet or cloudy weather. It is especially valuable in a household where there are children. It is easily made and installed, and will be of great convenience to the housewife, as it can be kept out of the way by being raised close to the ceiling when not in use. It may be made in the form of a square frame of wood, or a substantial centrepiece to which the two end pieces are attached. Lines are stretched from the end pieces to which the clothes are hung. The assembly is raised by simple cord connections, which pass over pulleys fastened to the ceiling. The

end of the cord is attached to an anchoring hook or cleat on the wall, and the device may be readily lowered for hanging the clothes, and then raised out of the way close to the ceiling while the clothes are drying or when the appliance is not in use. The dimensions indicated are only given as a guide, and obviously may be varied to suit the requirements of the individual, and the space available for hanging the dryer.

Improving Linen Closets.—A number of ways in which the capacity of closets of various kinds may be increased, and the material stored away in them made more accessible, are clearly outlined at Fig. 39, and the suggestions given are of such character that it may be easily followed by the home mechanic. The combined drawer and shelf, which is composed of a shallow tray opened at the front as outlined at Fig. 39, A, is much superior to either drawers or shelves of the ordinary form for storing away household linen such as sheets, towels, napkins, tablecloths, and other such objects, which may be piled up neatly on the sliding shelf. When a shelf is pulled out, it is possible to reach the material at the back end as easily as at the front. The shelves or trays are easily made in the usual manner, being simply shallow boxes without a front board and with the ends rounded. A draw pull is attached to each shelf so that it may be easily pulled out of place. As many holders are provided as is deemed necessary, and the door of the closet will keep out the dust.

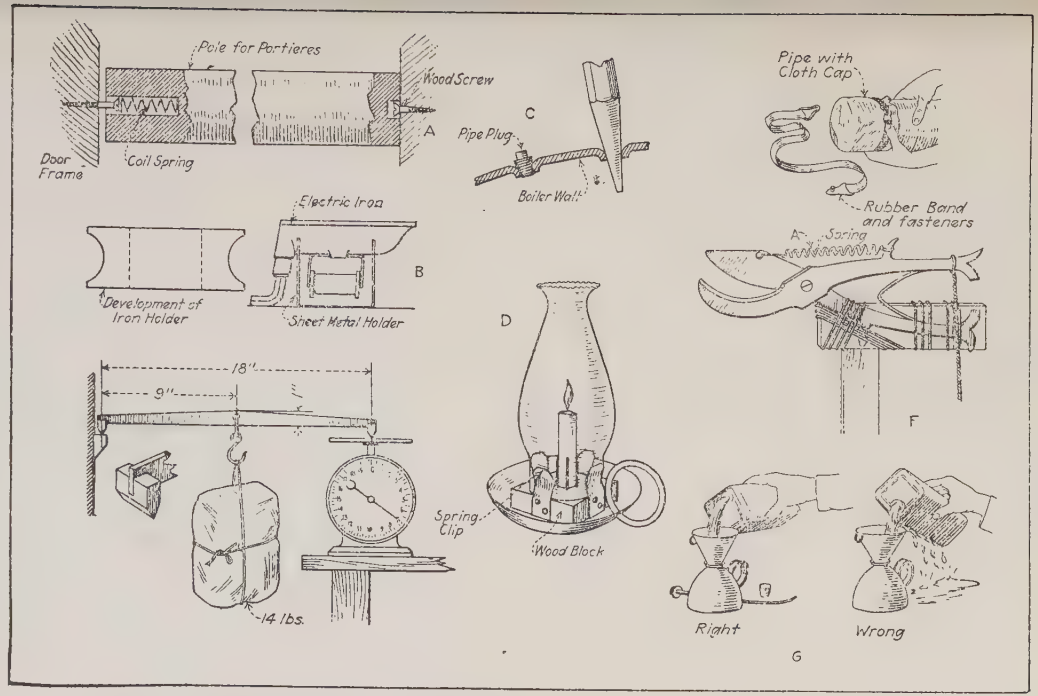

FIG. 40.—MISCELLANEOUS SUGGESTIONS FOR DOING HARD THINGS IN AN EASY WAY.

Storing Kettles and Pans.—The illustration at B outlines a cupboard in which various kitchen utensils may be stored in orderly fashion without occupying an excessive amount of room, and at the same time being out of sight and readily accessible. The cupboard is a simply made box of sufficient depth and width to receive the largest of the utensils ordinarily used. It may be made as high as desired, but it is not advised to make it more than 7′ high as any pot or pan may be reached easily if that height is considered the maximum. The sides of the closet are provided with small wooden cleats, to form the shelf rest, or the sides may be scored at even intervals, say every 4″, with sawcuts about $\frac{3}{8}$″ deep. The shelves may consist of squares of galvanized iron, and are held in place by being inserted into the grooves or rested on the cleats. It is recommended that the groove system be followed because the shelves are held securely, and may be readily adjusted in different grooves to accommodate utensils of different sizes. The closet may be made of any desired wood, which may be given a finish to match the woodwork of the kitchen. If it is desired to paint the cabinet white, the wood used need not be so good in quality as that necessary if a natural finish is desired. The door may be made in panelled form, and is attached to the closet by suitable hinges.

Trouser Hanger for Closet.—An easily made trouser hanger, that will provide accommodation for from four to six pairs without losing the crease,

may be easily made by the handy man as illustrated at Fig. 39, C. A wood frame is made, which is hinged to the inner side of the door, having chains to prevent it from dropping too far when it is released. Cross-bars made of brass curtain rods, or of steel rods, are assembled into the frame as shown, over which the trousers are hung. The frame is lowered to remove the trousers or to place them in position, and after these are in place, the frame is swung up flat against the door and held in position by a small hook and screw eye arrangement.

Installing Curtain Pole.—The method of hanging a pole or support for curtains or *portières*, shown at Fig. 40, A, is a very good one, because no fixtures are needed, and the pole is held as securely as though more expensive fastenings were employed. The pole is cut about $\frac{1}{4}''$ shorter than the space between the door casings. A $\frac{3}{8}''$ hole is drilled in each end, one about $\frac{3}{8}''$ deep and the other about $1\frac{1}{4}''$ deep. Ordinary screws, having a $\frac{3}{8}''$ wide flat or button head, are screwed into the door frame to act as bearings for the pole. A coil spring is placed in the deep hole as indicated. To put the pole in place, the end containing the spring is put on the screw, which projects the furthest, and the spring is compressed enough so that the pole may be moved up opposite the other supporting screw-head and placed over it. The pressure of the coil spring will keep the pole in place on the screws. If button-head screws are used, a superior bearing

will be obtained, as the screwheads will not cut into the pole.

Using Electric Flatiron for Stove.—A method of supporting an electric flatiron so that it may be used for heating water is shown at Fig. 40, B. A piece of sheet metal is cut to the shape indicated, and when the legs are bent up it forms an effective support for the electric iron. The frame may be made of wire or any other heat-resisting material. The utility of the ordinary electric flatiron for this work is so well recognized that some makers of these appliances furnish a stand with it so that it can be used as a hotplate or stove when desired.

Range Boiler Repair.—It is a general impression that is fostered by plumbers, that punctured hot-water range boilers cannot be repaired, and they are justified in their claim to some extent if repairs are attempted by means of solder, which will not always hold against pressure. Of course, if the home mechanic is a capable workman and understands the method of sweating a patch in place on the boiler, a secure repair may be made. The method shown at Fig. 40, C, has been recommended, and will make a satisfactory repair in some cases. The tapering end punch is driven into the hole so that the point of a small machine screw or small pipe plug will just enter. A tap is then screwed into the hole to cut the thread, and a suitable plug or screw is screwed in after its threads have been smeared with red lead or other pipe joint compound. If solder is run in around the threads and the pro-

jecting portion of the screw or plug, an absolutely tight joint will be obtained.

Cheap Candle Lamp.—The candlestick holder shown at Fig. 40, D, is easily made, and will prevent the candle from being blown out by the wind, as it is carried from place to place. A block of wood of the same diameter as the lamp chimney forms the base, to which spring clips are tacked or screwed to hold the chimney in place. The size of the candle base is marked out on the block by tracing its outline with a lead pencil, and three fine wire nails are driven in the block, spaced equidistant on the circle, indicating the base of the candle, to form a holder for it. Short candles are used, and as the flame burns steadily without the flicker that is noticed when the candle is exposed, as in the ordinary candlestick, a good light is obtained. Another advantage is that the candle lamp is much safer than the usual open form, as curtains cannot come in contact with the flame, as it is protected by a chimney. The wood block is set into a metal saucer to which a ring or piece of sheet material is soldered to serve as a finger-hold, or it may be used without the pan by attaching it to a larger block.

Keeping Soot in the Stove-pipe.—One of the tasks that is not relished by either the housewife or the home mechanic is removing the stove pipe for cleaning, as the dirt and soot collects in the pipe and falls out all over the clean floor and over the

persons manipulating the pipe. A simple cloth cap, as shown at Fig. 40, E, may be held in place over the open end of the pipe by a piece of rubber band provided with any suitable fastening. A paper bag tied on with a piece of twine will answer the purpose and keep the soot in the pipe while it is being carried. In localities where several stoves must be taken down every spring and stored away for the summer, this little hint will be found of value.

Clipping Trees without a Ladder.—An extension handle for a tree clipper may be easily extemporized for pruning high branches on small trees that are not sufficiently strong to hold a ladder: it is shown at Fig. 40, F. A crosspiece is nailed to the end of a long handle, and the clippers are securely attached to it by means of heavy cord or wire. The jaws are kept apart by a coil spring which fits into a hole drilled in one of the cutting blades at one end, and around the finger-rest hook at the other. A wire or cord is attached to the movable clipper handle, and forms a connection by which the operator on the ground may move the clipper jaw to cut off the small branches and twigs that are ordinarily removed in pruning, and that could not be reached in any other way.

Emptying Square Oil-can.—When turning oil from a square oil-can, an inexperienced person is apt to spill a considerable amount, because the oil gurgles out and runs down the side of the can as indicated at Fig. 40, G. The can should be held

so that the opening is at the upper corner instead of the lower one, and the stream of oil coming out of the hole should not be the full size of the orifice, in order to allow air to enter the can and take the place of the displaced oil.

Doubling Capacity of Spring Balance.—Spring scales ordinarily used in the household, whether of the platform type or of the extensible spring form, are limited in capacity, and when it is desired to weigh the contents of a package that weighs more than the capacity of the scale, the usual method is to weigh the contents of the package in sections if the material is of such form that it may be divided into smaller packages. It is sometimes necessary to weigh a large package that cannot be divided, so the suggestion given at Fig. 40, H, may be followed. In this, a simple beam or lever is used, and the package to be weighed is suspended from its centre. One end of the beam may be hung from any suitable support, which should be on a line with the top of the scale, while the other end is attached to the scale hook or pan, resting on the centre of the latter, depending on the type of spring balance employed. In this way, packages weighing twice as much as the capacity of the scale may be weighed, as only half the weight of the package will be indicated by the spring balance. While the beam shown is carefully made, any odd stick can be used as a lever. The necessary precautions to insure accuracy in weighing are, that this rests at but a single point at either end, and that the hook

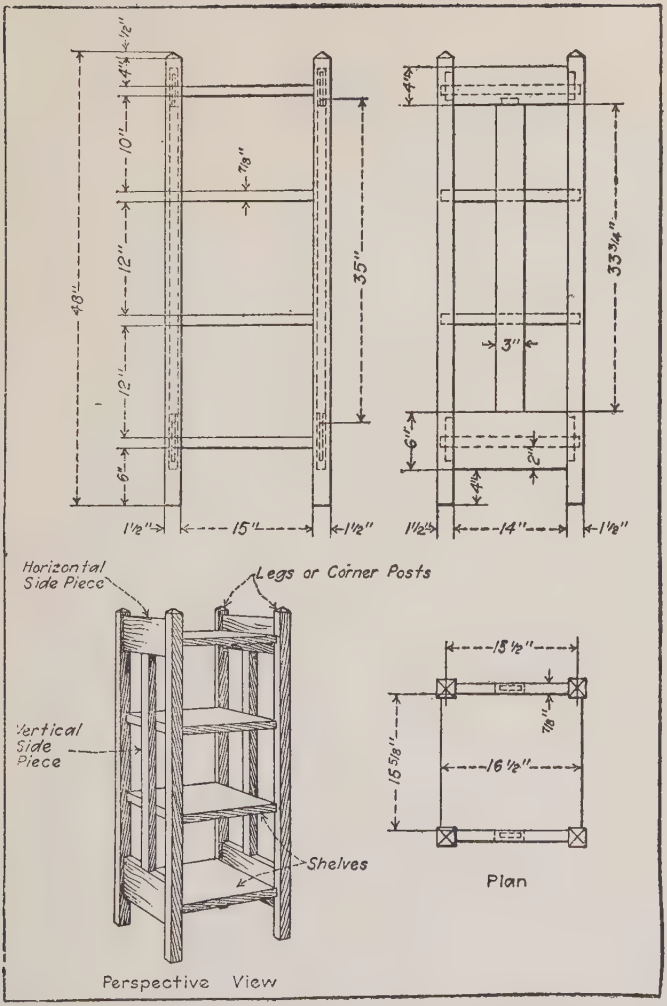

FIG. 41.—WORKING DRAWINGS FOR MAKING MAGAZINE RACK IN THE HOME WORKSHOP.

for supporting the package be placed directly in the centre of the beam.

Simple Magazine Rack.—The handy man or boy, who would like to try his hand at simple joiner work or cabinet-making, can spend several evenings profitably in making the magazine stand shown at Fig. 41. The material recommended is quarter-sawed white oak, though it may be made of other wood, such as maple or birch, and stained or painted any suitable finish. When white oak is used, the wood may be fumed, because it contains tannic acid, while a smooth surface wood, such as birch, takes a mahogany stain well, or an enamel. Even such an ordinary wood as white or yellow pine may be used if the stand is to be painted. The stock may be ordered from the mill cut to size as given in the following list of material, or the workman may get the pieces out himself from whatever odds and ends of lumber he has available.

LIST OF MATERIALS

Name of Part.	No. required.	Size.
Legs or Corner Posts .	4	$1\frac{1}{2}''\times 1\frac{1}{2}''\times 48''$
Shelves. . . .	4	$\frac{7}{8}''\times 15\frac{5}{8}''\times 16\frac{1}{2}''$
Vertical Side Pieces .	2	$\frac{7}{8}''\times 3''\times 35''$
Horizontal Side Pieces .	2	$\frac{7}{8}''\times 6''\times 15''$
Horizontal Side Pieces .	2	$\frac{7}{8}''\times 4''\times 15''$

In building the rack, the first thing to do is to assemble the sides. Cut the tenons on the top and bottom horizontal side pieces, and also on the vertical side strips. The mortises are cut exactly in the centre of the side pieces to receive the tenons on the vertical pieces. The corner posts are then

mortised out to receive the tenons on the ends of the horizontal side pieces. These pieces are glued and held together by clamps for at least 24 hours. The shelves may be cut of one wide board or built up as conditions demand. The corners should be

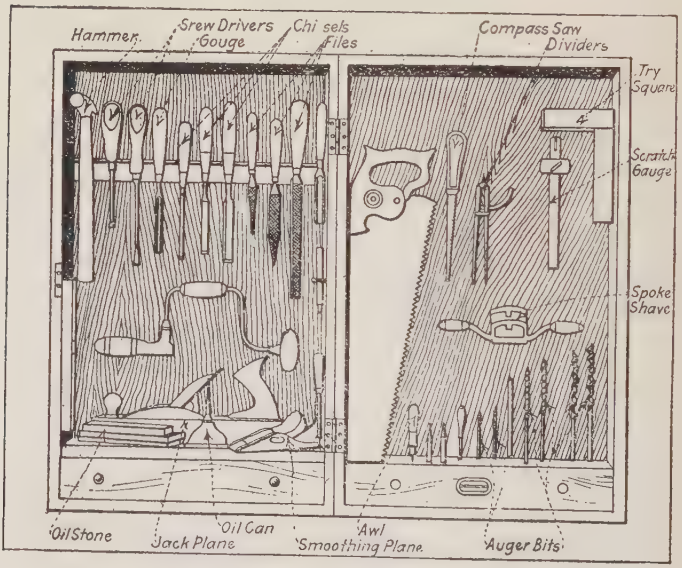

FIG. 42.—A TOOL CABINET FOR THE HOME WORKSHOP.

cut accurately so that they will fit the legs. There is a variety of ways of securing the shelves to the corner posts. They may be held by flush-head wood screws, by small lags, or by nails. The sides and shelves should be scraped and smoothed with sand-paper before assembling, as the work is more easily done when the parts are separated. In sand

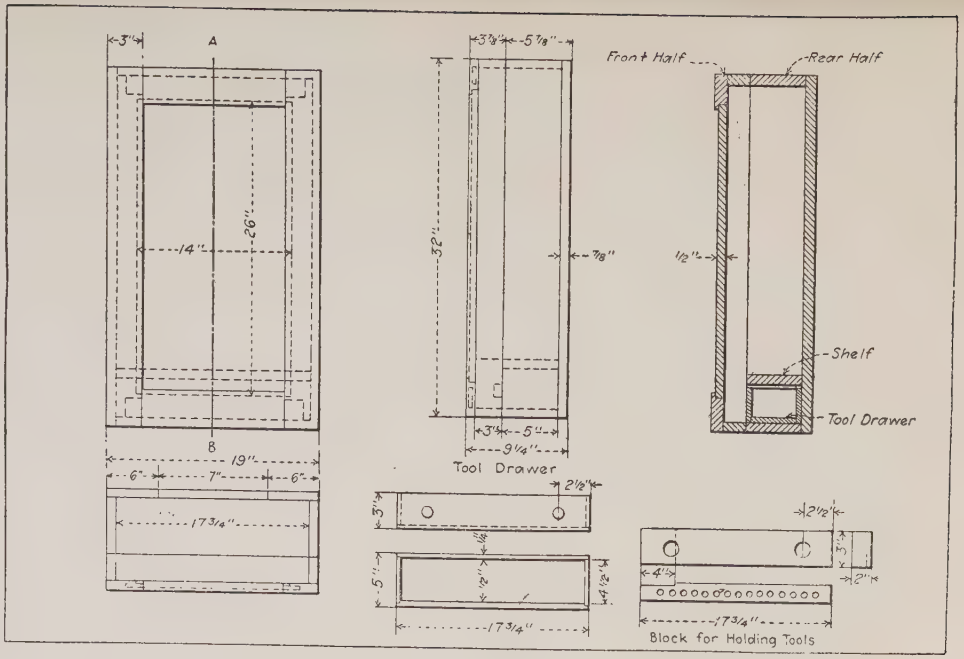

FIG. 43.—WORKING DRAWINGS FOR BUILDING A PRACTICAL TOOL CABINET.

ing, one should always rub with the grain of the wood to avoid scratches.

Fuming is accomplished by standing the finished rack, if of oak, in an air-tight box, and standing several dishes of strong ammonia around the stand where the fumes will rise. The ammonia will react with the acid in the oak, and after ten hours a deep rich brown shade will result. Any cracks in the box or its cover may be sealed sufficiently tight by pasting strips of paper over them to keep the fumes confined around the rack. After the wood is coloured, a furniture wax finish should be applied.

Cabinet for Wood-working Tools.—The cabinet shown at Fig. 42 is not difficult to make, and provides an ideal place for storing away wood-working tools when not in use, so these are kept clean, dry, and in good condition as regards cutting edges. It may be made of cheap wood and painted, but if the home mechanic wishes to make a real job of it, he can use oak, walnut, or mahogany, or combinations of wood to make a cabinet that will be ornamental as well as useful.

The cabinet consists of two shallow boxes, one serving as a cover for the other. The shallowest box serves as a cover or front half, and is 32″ high by 19″ wide by $3\frac{7}{8}$″ thick, outside dimensions. The panel front is made of a frame of $\frac{7}{8}$″ stock to which a $\frac{1}{2}$″ thick panel board, 14″ × 26″ is attached, being held in place by a suitable rabbet or ledge in the frame pieces. The deeper box is made entirely of $\frac{7}{8}$″ stuff, and is 32″ high by 19″ wide by $5\frac{7}{8}$″ deep,

outside dimensions. If the stock is dressed down to $\frac{3}{4}''$ thickness, the dimensions will vary slightly from those given. A shelf is placed $3\frac{1}{16}''$ above the bottom, and a small drawer fills the space between the shelf and bottom of the rear half as shown. The only mortise and tenon joints are in the front panel frame, the top and bottom end frame pieces carrying tenons to fit mortises in the side pieces. All other joints, except those of the panel front and drawer, are of the butt nailed or screwed joint form. The drawer front is made of $\frac{1}{2}''$ stock, the sides, back, and bottom is $\frac{1}{4}''$ thick stock. The two halves of the cabinet are held together by hinges, so that the front half may be swung open and all the tools the cabinet contains will be easily accessible.

The drawer shown is used for smaller tools such as punches, nail sets, chisels, etc., that are not provided for otherwise. A tool-holding piece is placed at the bottom of the front half of the cabinet. Two holes are cut into the face to receive the drawer pulls, and a series of holes are drilled in the top to receive various bits and other tools. As all dimensions are given, as well as structural detail, the home mechanic will have no trouble in following the diagrams and building a practical cabinet that will last a lifetime. The list of materials appended gives the sizes of the pieces needed to complete the work. The length given for the front frame top and bottom end pieces allows for cutting the tenons in the ends. The ledge running around the inside of the frame may be cut in with a plough

plane, or may be made by making a saw-cut of the proper depth on the face of the pieces before assembly, and cutting in to meet it with a chisel, gradually cutting out the material.

LIST OF MATERIALS

Front Half of Cabinet

Name of Piece.	No. Required.	Size.
Front Panel Frame Side Piece	2	$\frac{7}{8}''\times 3''\times 32''$
Front Panel Frame End Piece	2	$\frac{7}{8}''\times 3''\times 16\frac{1}{2}''$
Front Box Sides	2	$\frac{7}{8}''\times 3''\times 32''$
Front Box Ends	2	$\frac{7}{8}''\times 3''\times 17\frac{3}{4}''$
Front Panel	1	$\frac{1}{2}''\times 14''\times 26''$
Tool-holding Block	1	$2''\times 3''\times 17\frac{3}{4}''$

Rear Half of Cabinet

Rear Box Sides	2	$\frac{7}{8}''\times 5''\times 32''$
Rear Box Ends	2	$\frac{7}{8}''\times 5''\times 17\frac{3}{4}''$
Back Board	2	$\frac{7}{8}''\times 6''\times 32''$
Back Board	1	$\frac{7}{8}''\times 7''\times 32''$
Shelf Board	1	$\frac{7}{8}''\times 5''\times 17\frac{3}{4}''$
Drawer Front	1	$\frac{1}{2}''\times 3''\times 17\frac{3}{4}''$
Drawer Back	1	$\frac{1}{4}''\times 2\frac{3}{4}''\times 17\frac{3}{4}''$
Drawer Ends	2	$\frac{1}{4}''\times 2\frac{3}{4}''\times 4\frac{1}{2}''$
Drawer Bottom	1	$\frac{1}{4}''\times 5''\times 17\frac{3}{4}''$

CHAPTER IV

HOW TO DO THINGS ELECTRICAL

Electric Bell and Indicator Wiring—Push-button Construction—Electric Wires and Wiring—Simple Batteries—Dry Cells—Wiring Dry Cells—Electric Bell Construction—Simple Bell Circuits—Conventional Domestic Installation—Joining Wires—Overflow Alarm—Simple Indicator—Electric Alarm Clock—Simple Fire Alarms—Simple Terminals—Magnetizing Shears—Using Partly Worn Zincs—Electrically Operated Door Locks—Replacing Defective Fuses—Simple Attachment Plugs—Controlling One Lamp from Two Points—Home-made Night Light—Drop Light Adjusters.

In a treatise of this kind, one cannot expect to give detailed information that will make an electrician out of the average man, but there are many little electrical jobs that can be done by the home mechanic even though he is not versed in all phases of electrical science. In this chapter, the various electrical jobs one could expect to do around the home are described and illustrated, but no instructions are given for power motor installation, because such work calls for a professional electrician, such as does house wiring for lighting. Bell and indicator work is easily performed without danger, so it is gone into in some detail.

Electric Bell and Indicator Wiring.—One of the most frequent electrical jobs of the handy man

around the house is tracing out trouble in bell wiring circuits, or in installing call bells or indicators to supplement those already in the house. It is often necessary to install a bell in an upstairs bedroom, with a push-button downstairs, or to rig up various forms of alarms, and a knowledge of simple wiring will be found advantageous in many ways. The parts of an electric bell system are simple and not hard to understand. For a simple circuit, one needs batteries which are a source of current, a push-button switch to control the electrical flow, wires over which the electricity can pass, and bell or indicators in which the electricity performs useful work.

Push-button Construction.—The construction of a simple push-button switch is clearly shown at Fig. 44, A. This consists of a base block of wood or other insulating material to which a metal contact strip is attached, which lies flat on the base, and also a contact spring which is normally out of contact with the lower strip unless it is pressed down against it by a push-button. The push-button is always made of insulating material. In the cheaper switches, wood or hard rubber is used; in more expensive ones, ivory is sometimes employed. It will be evident that, when the spiral or curved spring is brought in contact with the strip on the face of the switch, the circuit will be closed and current can flow through as long as the push-button is kept pressed down. As soon as the pressure is released from the push-button, the contact

spring has sufficient elasticity to keep the push-button pressed up, and it is no longer in contact with the lower spring. On account of the air-space existing between the springs, no current can pass and the circuit is broken.

When trouble is experienced with an electric bell, if the push-button is installed in an exposed place, it is important to unscrew the cover and make sure that the contact springs are not corroded, and that a clean metallic surface is present at the contacts. The wires should also be tested at the point where they join on to the metal strips in the switch, as the screws holding them may be loose.

Electric Wires and Wiring.—The various wires that are used in electrical installations for both lighting or bell work differ according to the amount of voltage and ampèrage of the current passing over them. Wires to be used in a lighting circuit of 110 volts or 220 volts pressure must be more heavily insulated than those which carry only a few volts, such as are used in bell ringing or indicator circuits. Wire ordinarily known as "bell wire" may be purchased at any hardware store, wound on spools of various capacity. It is a single strand of copper covered with wax thread insulation. Sometimes this bell wire may be obtained in duplex or other multiple strand cables. The wire used for lighting purposes is usually a twisted cord having a multiple strand conductor, which is protected by both rubber and woven fabric insulation.

Bell wire may be obtained with insulation of

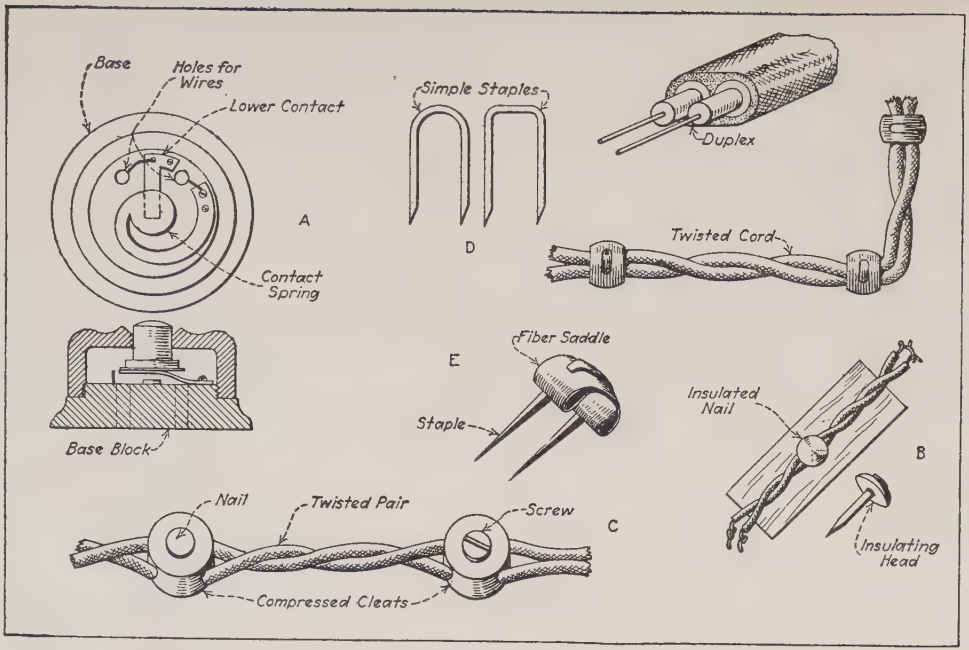

FIG. 44.—PUSH-BUTTON SWITCH CONSTRUCTION SHOWN AT A; WIRING AND STAPLES FOR HOLDING IT IN PLACE SHOWN IN OTHER DRAWINGS.

various colours and combinations of outer covering weaves, so that, in running a number of circuits where the separate wires must run along together, it is possible to recognize the various wires of a circuit by their difference in insulation when these are all brought out at a common point. If this were not done, confusion with other wires might otherwise exist in making a connection. The method of holding the wiring in place is very simple. Twisted cord, or, as it is sometimes called, "twisted pair," may be held by special tacks having an insulating head as shown at Fig. 44, B, by fibre cleats held by nails or screws, as outlined at Fig. 44, C, and by staples shown at D, or staples provided with a fibre saddle as shown at E. Wherever wires carry currents of moderately high voltage, this fibre should always be interposed between the wire and the staple as shown at Fig. 44, E.

The simple staples are not recommended even for bell work unless they are carefully driven down, for, if they are put in place with heavy hammer blows, they are apt to cut through the insulation and even break the wires. The former may cause a short circuit, the latter will surely result in an open circuit. In running wires on old work, advantage is taken of door frames, picture mouldings, and other interior trim, to conceal the wires. In new work it is evident that they may be run before the plastering is done, and this can be properly concealed.

Simple Batteries.—The batteries used to supply

electricity are of the open circuit type and operate on the same principle, even though they differ materially in construction, as shown at Fig. 45. The set cell, or modified Leclanche, has long been popular because of its cheapness and simplicity, and the ease with which the elements may be cleaned and solution renewed. It consists of a carbon cylinder as outlined at A, having a boss on one side through which the terminal post passes, and a hole at the centre to receive a porcelain insulator that supports the zinc stick and keeps it from electrical contact with the carbon. The carbon cylinder is flanged to fit into a suitable glass jar. The solution is ammonium chloride or sal-ammoniac and water. The charge is about 3 ounces salt to three-quarters the contents of the battery jar of water. When the current output becomes weakened from a cell of this kind, it is usually due to the electrolyte becoming weak through crystallization of the salt, or the zinc stick being eaten away.

The cell may be restored to efficiency by removing the old solution and crystals deposited in the jar and on the carbon cylinder by thorough washing in warm or hot water. The carbon cylinder is then scraped inside to secure a good surface, and set in the sun until dry. A new solution is made to which is added a tablespoonful of cane sugar, which prevents or reduces the deposition of salt crystals, a new zinc stick is inserted in the carbon cylinder, and the whole placed in the jar. The

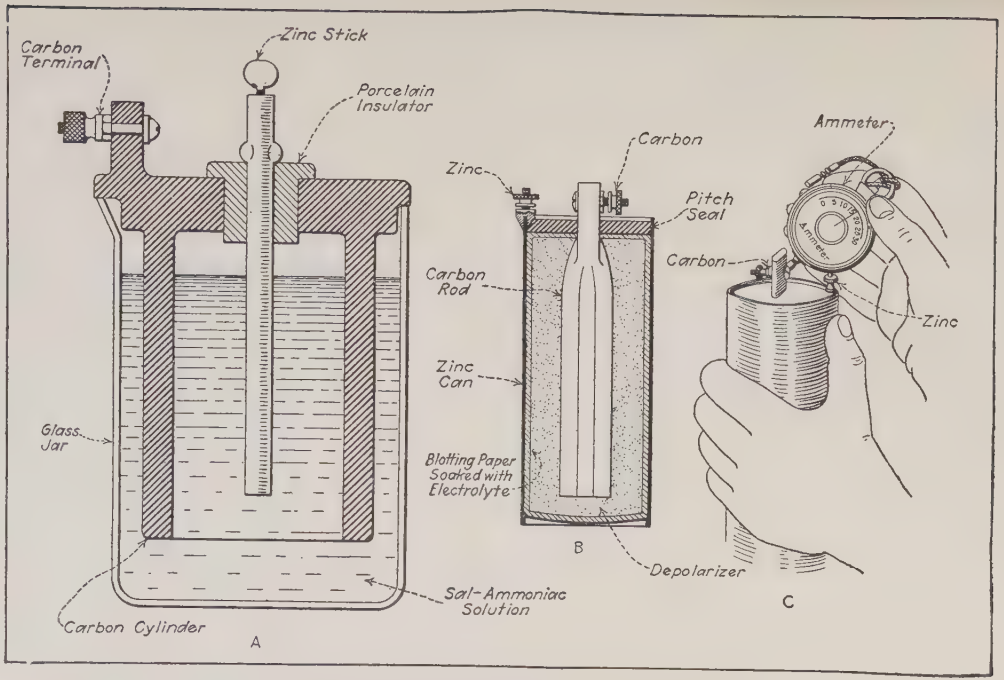

FIG. 45.—SAL-AMMONIAC CELL USED FOR BELL AND INDICATOR WORK SHOWN AT A. THE DRY CELL IS SHOWN AT B, AND METHOD OF TESTING WITH AMPÈREMETER AT C.

terminals of both carbon and zinc stick should be bright and clean, and the wire brightened where fastened to the terminals, by scraping off any shreds of insulation or particles of wax adhering to it, and having a clean, bright copper in contact with the terminal screw or nut.

Dry Cell Batteries.—A cleaner and more convenient type of current producer is becoming popular for bell-ringing and other household demands for intermittent supply such as indicators, alarms, etc. This is known as a dry cell, and consists of a zinc can, in the centre of which a carbon rod is placed as shown at Fig. 45, B. The electrolyte is held close to the zinc or active member by an absorbent lining of blotting-paper, and the carbon rod is surrounded by some depolarizing material. The top of the cell is sealed with pitch to prevent loss of depolarizer.

The depolarizer is needed that the cell may continue to generate current. When the circuit of a simple cell is completed, the current generation is brisker than after the cell has been producing electricity for a time. While the cell has been in action, the carbon element becomes covered with bubbles of hydrogen gas, which is a poor conductor of electricity and tends to decrease the current output of the cell. To prevent these bubbles from interfering with current generation, some means must be provided for disposing of the gas. In dry cells, the hydrogen gas that causes polarization is combined with oxygen gas evolved

by the depolarizing medium, and the combination of these two gases produces water, which does not interfere with the action of the cell. Carbon is used in a dry cell because it is a cheap and satisfactory inactive material, and the electrolyte is a mixture of sal-ammoniac and chloride of zinc, which is held in intimate contact with the zinc shell which forms the active element, by a blotting-paper lining.

Wiring Dry Cells.—A single dry cell will not produce sufficient current to ring a bell energetically, therefore it is common practice to combine two or more cells in such a manner that batteries are formed which will give more power than a single cell. If it is desired to increase the voltage, the cells are connected in series. If one dry cell will produce one and a half volts, and three volts are needed, the current value of one dry cell is augmented by coupling one more to it in a series connection. When cells are connected in series, it is the unlike elements which are joined together. For example, the zinc of one cell should be joined with the carbon of the adjacent member by a flexible conductor. This will leave the carbon of one end cell and the zinc of the other end cell free, so that they can be joined to the apparatus in the outer circuit.

When it is desired to obtain more ampèrage or current quantity than could be obtained from a single cell, as in lighting, they are joined in series multiple connection. With this method of wiring,

two or more sets of any reasonable number of cells which have been joined in series are used. The zinc of one set is joined with the zinc element of the others, and the carbons are similarly connected. Any number of sets of cells may be connected in series multiple, and the ampèrage of the combination is increased proportionately to the number of sets joined together in this manner.

When either dry or wet cells are connected in series, the voltage of one cell is multiplied by the number of cells, and the ampèrage obtained from the set is equal to the ampèrage of one cell. When connected in multiple, the ampèrage is multiplied by the number of cells so joined, but the voltage is that of one cell. When the ampèrage of a dry cell, tested by a small meter as shown at Fig. 45, C, is less than four or five ampères, it should be discarded and a new one supplied, because there is no really economical method of recharging them.

Electric Bell Construction.—The electric bells that are used are very simple in construction. An electro-magnet attracts the armature, to which a clapper or striking rod that hits the gong is attached. When a current of electricity passes through the bell, it energizes the magnet, which attracts the armature, causing the clapper to ring the bell. The vibrating bell is shown at Fig. 46, on the left. The wiring is very clearly shown in the diagram. The armature spring serves to convey the current from one terminal, through a platinum-tipped contact screw, to the winding around one leg of the

magnet. From that point the current flows to the coil around the other leg of the magnet, and from that to the remaining terminal on the bell base.

The reason the bell vibrates is due to the automatic breaking of the circuit, which is accomplished when the armature is attracted by the magnet. As

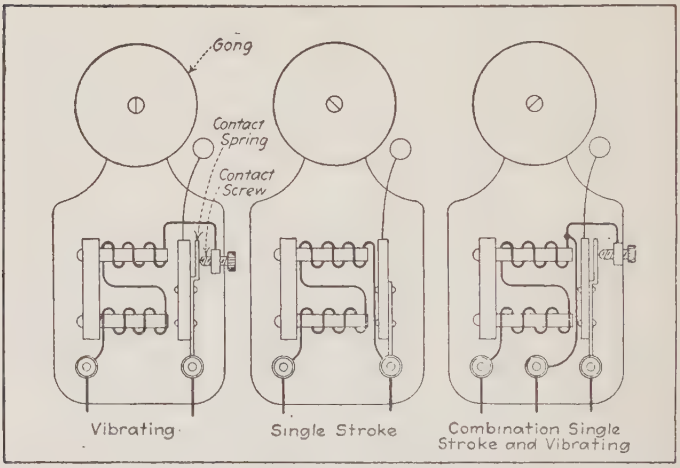

FIG. 46.—WIRING CONNECTIONS OF THREE DIFFERENT TYPES OF ELECTRIC ALARM BELLS.

soon as this happens, the contact is broken at the adjustable screw, and the magnet ceases to attract the armature, which flies back because of the spring, and again comes in contact with the screw. Naturally, as the current can again flow through the magnet windings, the magnet cores are again energized, and will attract the armature. Each time that the armature is attracted, the striking

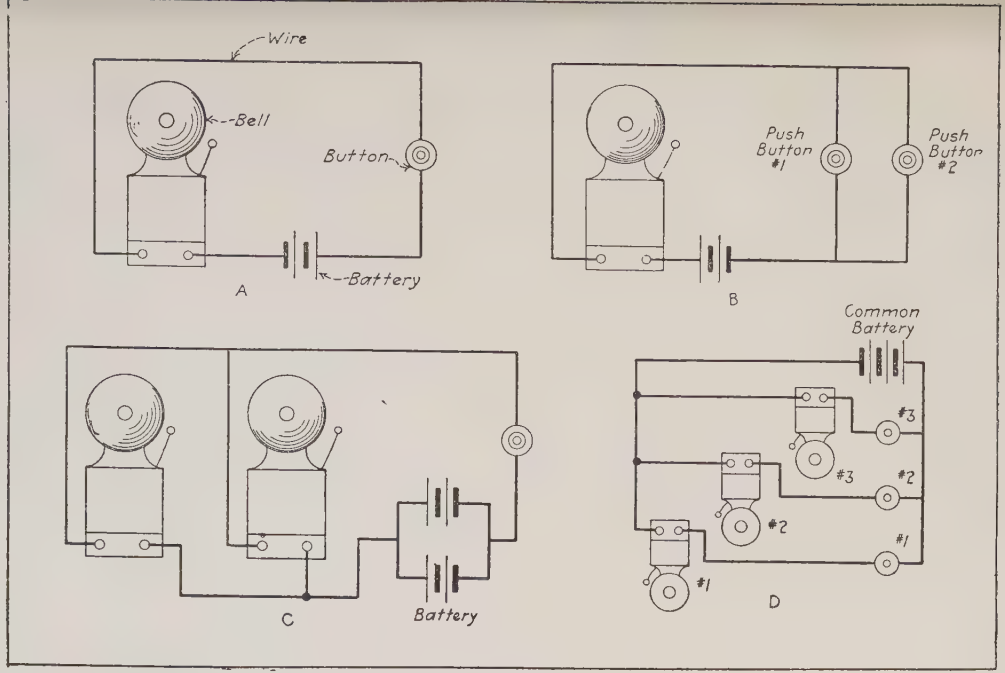

FIG. 47.—CALL BELL CIRCUITS, THE SIMPLEST BEING SHOWN AT A. B, RINGING ONE BELL FROM TWO POINTS. C, RINGING TWO BELLS FROM ONE POINT. D, HOW ONE BATTERY CAN SERVE THREE CIRCUITS.

hammer will give the gong a blow, and usually the adjustment is such that the armature will vibrate many times a second.

The single stroke form of bell, which is shown at Fig. 46, in the centre, has no contact screw and does not vibrate. It strikes the bell once for each time the push-button is pressed down. For this reason it is well adapted for code signalling purposes. The combination form of bell, which is shown at Fig. 46, on the right, has three terminals, and is wired in such a way that it may be employed either as a single stroke bell through one push-button or as a vibrating bell if operated through another button.

Simple Bell Circuits.—A variety of bell circuits is shown at Fig. 47. That at A is the simplest, and consists merely of a push-button and battery in series with the bell. When the push-button switch is operated, the circuit for the passage of electricity is complete and the bell will ring. By placing two push-buttons in parallel connection as shown at Fig. 47, B, it is possible to operate the bell from two different places. If it is desired to actuate two bells with one push-button, the circuit is as outlined at Fig. 47, C. In this case the bells are in parallel connection, though each bell is in series with the battery and push-button. When it is desired to operate two or more bells, each with its own push-button control, the circuits may be arranged as shown at Fig. 47, B.

Conventional Domestic Installation.—The usual domestic installation is as shown at Fig. 48.

Two bells and a buzzer are provided, all of which are placed in the kitchen or pantry. One control button is used to ring the front door bell; one is installed at the back door to ring the bell having a square gong, so as to give it a different tone, and the push-button controlling the dining-room buzzer is generally in the form of a foot-controlled switch

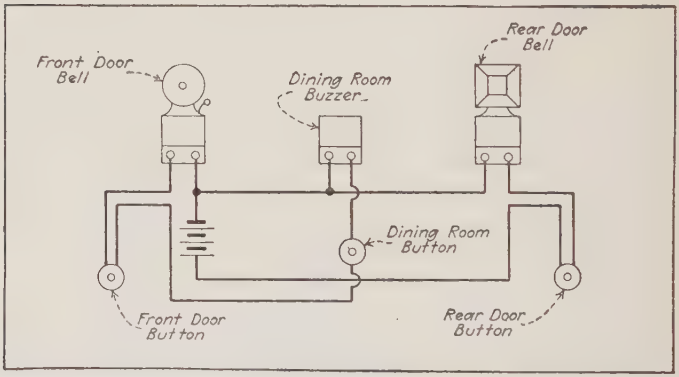

FIG. 48.—THE CONVENTIONAL DOMESTIC CALL BELL INSTALLATION SHOWN BY SIMPLIFIED DIAGRAM.

placed under the rug, where it can be operated without difficulty by the head of the family. The wiring involved is very clearly shown, and, while all parts of the system are grouped completely in the diagram, it will be evident that any of the wires shown may be extended as much as necessary to establish the desired connection between the parts comprising the circuit. Two dry batteries or wet cells, such as shown at Fig. 45, may be used if the wiring is not unusually long, and it is safe to say

that three bells at the most will furnish sufficient voltage for any ordinary domestic installation. For a short run, or where the bell is not a loud ringing form, or for operating a simple buzzer circuit from one room to another, one cell will be found adequate in most cases.

Joining Wires.—The connections between wires are usually made by stripping of insulation the ends to be joined, cleaning the copper wire thus exposed with emery-cloth, or scraping it with a knife so that the oxide or film is removed from the surface, and

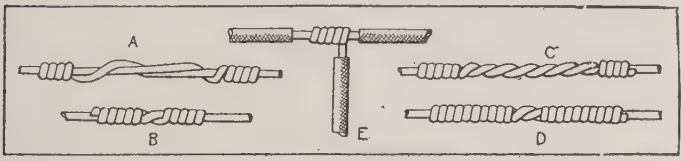

FIG. 49.—DIFFERENT METHODS OF JOINING ELECTRIC WIRES TO OBTAIN GOOD ELECTRICAL CONDUCTIVITY AND A STRONG JOINT.

then twisting the two wires together to form any of the joints shown at Fig. 49. While these joints are not usually soldered, as is advisable when running long circuits, it will be found advantageous to solder them, as a better electrical contact is obtained and the resistance of the circuit is materially reduced, which means that more of the current produced by the battery will flow through the device to be operated. After the joint has been made, it is covered with a winding of electrical tape, which acts as insulation. When joints are made in wires

conveying lighting current, they are further protected by a layer of rubber tape before the ordinary frictioned fabric, or electrical tape is wound around, and then the joints are painted with an insulating varnish to insure absolutely against leakage of current.

Overflow Alarm.—The drip pan that is placed

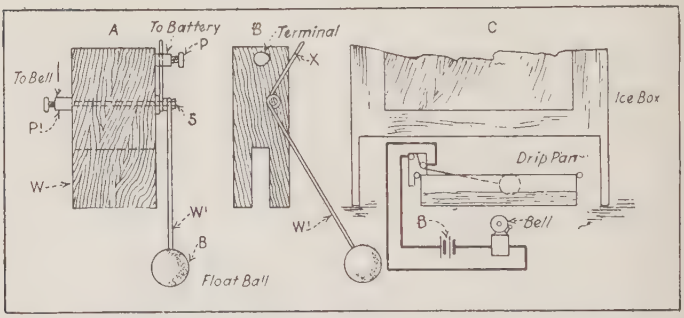

FIG. 50.—HOW TO MAKE AN OVERFLOW ALARM FOR THE REFRIGERATOR DRIP PAN.

under the refrigerator often overflows during hot weather, because the ice melts more rapidly than expected, and the pan is not emptied when it becomes full. The device shown at Fig. 50 is a very simple one that may be easily constructed by the home mechanic, and which will save considerable annoyance. The base piece is made of a piece of wood with a notch cut in the bottom so it may be attached to the side of the pan. The float is made of light wood or cork, that is attached to one end of a bent wire which is a loose fit on a bearing screw

so that the cork may move up and down. Two binding posts or terminals are attached to the wood base, one of these being in connection with the wire that carries the float ball, the other serving merely as an anchorage for one of the circuit wires. The installation of the device is clearly shown at Fig. 50, C. When the water rises, the float ball will also rise, and when the danger-point is reached, the bent portion, or short arm of the wire to which the float is attached, will come in contact with the binding post at the top of the board and establish a circuit through the battery and electric bell, which will result in an alarm being given that the water level has reached its maximum permissible height without overflowing.

The bell will continue to ring until the pan is emptied or circuit interrupted. It will be apparent that the water level at which the bell will ring may be altered as required by bending the contact wire, so that it will be in contact with the terminal post only at certain positions of the float. Bending the wire away from the terminal will increase the water level at which the alarm will ring, while bending it closer to the terminal will make the alarm bell ring sooner and for a smaller travel of the float.

Simple Indicator.—In some circuits one electric bell is operated from two push-buttons, and it is not possible to tell which button has operated the bell unless an indicator is used. The indicator shown at Fig. 51 is a very simple appliance that may be made by the handy man by using an electric

bell magnet and armature which is pivoted at the centre instead of at one end, as is usual in practice. An indicator or pointer is attached to the armature, and this moves to the right or left depending on which magnet of the pair is magnetized. When used in this way, the magnet coils are not joined in series, but each is independent of the other.

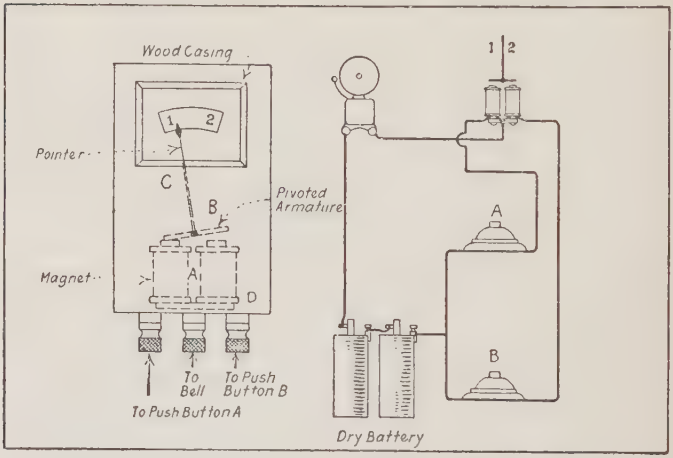

FIG. 51.—CONSTRUCTION OF A SIMPLE TWO-WAY INDICATOR.

The circuits are very clearly shown, one push-button being connected to the bell through one of the magnet coils, while the other can ring the bell only through the other magnet coil. The indicating arm will swing to one side or the other, and show clearly which push-button has been used to ring the bell.

Electrical Alarm Clock.—A simple method of using an ordinary alarm clock to operate an electric

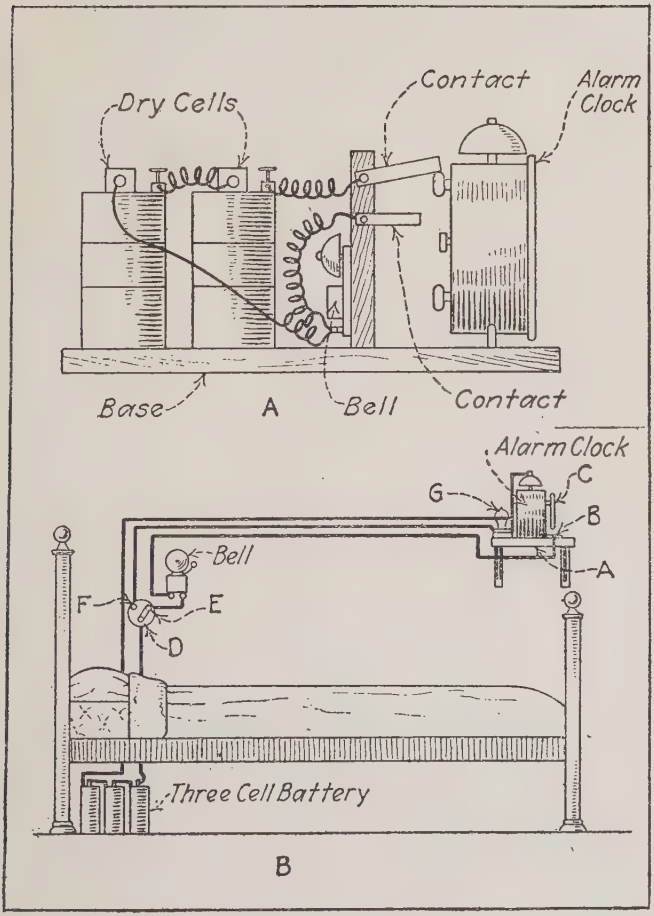

FIG. 52.—ALARM CLOCK OPERATED SWITCH AND SIMPLE BELL CIRCUIT GIVES A CONTINUOUS RINGING ALARM AT ANY DESIRED TIME.

bell, which will ring until the person it is desired to awaken gets up and shuts it off, is shown at Fig. 52, in the diagram at A. A metal arm or contact is rested on the winding key after the alarm is set. This arm should be of sufficient weight to establish a positive contact with the other arm carried below it when the winding key has released it and let it drop. The remainder of the wiring is very simple, and it is just as it would be for an ordinary electric bell circuit in which the push-button will replace the clock-operated switch.

A more complete wiring diagram, which is shown at Fig. 52, B, is so arranged that the electric alarm may be interrupted without leaving the bed, and also a light may be switched on if desired. The alarm clock rests on a suitable shelf which has a contact piece that may be used to establish the circuit when a metal piece is released by the clock-winding key as shown at A, Fig. 52. The two-point switch and bell are installed near the head of the bed. The switch is normally in such circuit arrangement that, when contact is established due to alarm going off, the electric bell will ring, but the switch lever may be moved over to the other contact button when desired, which will turn on a small electric light to illuminate the face of the clock, and thus enable the occupant of the bed to determine the time whenever he desires.

Simple Fire Alarms.—A cheap fire alarm arrangement that will indicate fire at places remote from the house, such as in a barn or storage shed, com-

prises the usual bell circuit with some form of switch that will automatically make contact either by thermostatic means, or by melting of a fusible substance or the burning away of a combustible one. The switch shown at A, Fig. 53, is operated by a weight, and is normally held out of contact by a string which passes around a series of small pulleys; this string is anchored at one end, and passes through the various rooms where there might

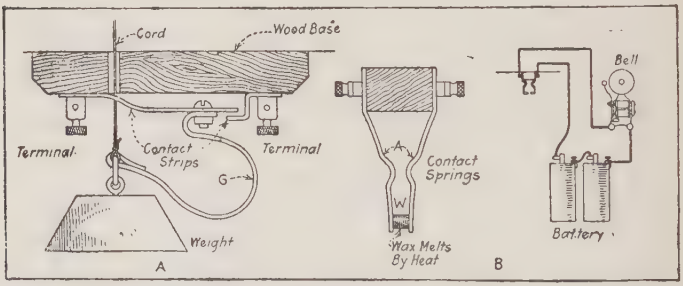

FIG. 53.—TWO FORMS OF AUTOMATIC SWITCHES TO USE WITH BELL CIRCUITS AND SECURE FIRE ALARM ADVANTAGES

be danger of fire. For instance, in a barn the string could pass through a haymow, where any flame would soon char the string, allowing it to become severed, and then permitting the weight to drop and establish an electrical contact at the switch. The electric bell is connected in the usual manner, and is placed in the house.

The automatic switch shown at B, Fig. 53, is easily constructed. It is made of a block of wood serving as a base, this having two strips of spring

brass attached to it. These springs have contact pieces which will be pressed tightly together when a piece of beeswax inserted between the ends of the brass strips melts from excessive heat. As soon as the brass strips come together, a circuit is established and the bell will ring. A number of these automatic circuit closers may be made and wired in parallel with one bell, so that they may be installed at various points which one desires to protect. If wired through an indicator, just as push-buttons would be, fire in any of several rooms, such as in a storage warehouse, would be immediately indicated at some central point by the indicator.

Simple Terminals. — The suggestion given at Fig. 54, A, shows how a very satisfactory terminal for connecting the ends of wires to batteries or to any electric apparatus having binding posts may be made by using ordinary split pins of the proper size. The end of the wire is passed through the eye of the cotter pin, twisted around itself, and then the pin and wire soldered together and covered with a piece of tape. A connection of this kind is superior to the use of the copper wire, as it is much stronger, and the wire is apt to be cut or broken by the pressure of the clamp screw because of its softness. A better connection is obtained because the legs of the split pin are normally spread apart slightly and will fit the hole in the terminal nicely.

Magnetizing Shears.—A pair of magnetized shears or scissors is a very handy thing for a housewife to have, because it will enable her to pick up a needle

or steel pin from the floor without difficulty. The method of magnetizing is very simple, and may be done with a small horseshoe magnet as shown at Fig. 54, B. The poles of the magnet are placed in contact with the scissors blades near the hinge, and are drawn towards the end of the blade. A number of strokes of the magnet are all that is necessary to magnetize the scissors blades. If

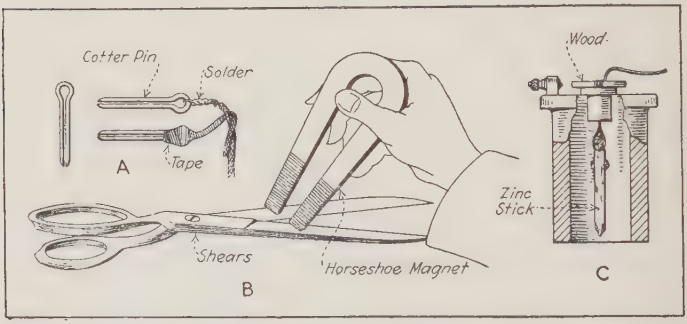

FIG. 54.—HOW COTTER PIN CAN BE USED AS A WIRE TERMINAL AT A. METHOD OF MAGNETIZING SHEARS AT B. USING PARTIALLY CONSUMED ZINC AT C.

these are of steel, they will remain permanently magnetized. The only precaution to be observed is to make sure that the same poles of the magnet come in contact with the same blades of the scissors at each stroke of the magnet.

Using Partly Worn Zinc.—A simple way of using a battery zinc that has been partly eaten away is shown at Fig. 54, C, and serves in an emergency. It is suspended by a wire, and after a good connection is made at the binding post, the end of the zinc

and wire is coated with wax to prevent corrosion, which will otherwise occur from the action of the electrolyte if it were not prevented by the insulation. After the zinc is dropped down into the solution—the proper amount—the wire is twisted around a piece of wood, which is placed across the insulator as shown, to hold it in place.

Electrically Operated Door Locks.—Two suggestions for electrically operated door locks are shown at Fig. 55. That at A is a very simple form, in which a long bolt is normally kept in the locked position by means of a weight or small spring, and which is unlocked by pressing a push-button, which energizes the magnet, and which draws the armature or locking bolt out of engagement with the locking screw-eye. As soon as the pressure on the button is released, the long bolt will swing back into locking position. The electric lock shown at Fig. 55, B, is a much stronger method than that shown at A. In this, when the door-locking bolt is pushed into position, it is locked by a trigger member dropping into the notch in the end of the bolt. When the push-button is pressed and the circuit completed, the magnet lifts the locking trigger, which permits a withdrawing of the bolt and unlocking the door. The circuits are very simple ones, being practically the same as those used in electrical bell work.

Replacing Defective Fuses.—When the light goes out suddenly in the household, experience has demonstrated that, unless the main power supply has failed, the trouble is undoubtedly due to the

blowing of a fuse in the main or one of the branch circuits of the house wiring system. Unless one is sure of the cause of blowing out of the fuse, a new fuse should not be placed in the fuse block without some investigation to determine the reason why the fuse was blown out. The function of the fuse is to act as a safety-valve that will protect the circuit against overload by melting, and thus interrupt the current flow. Any short circuit in the wiring system, or in any of the appliances connected to it, will cause a fuse to blow out, though at times some of these "blow" because of depreciation, caused by time, of the fusible alloy wire in the fuse-plug. The construction of the usual fuse-plug is clearly shown at Fig. 56, A. This consists of a screw base similar to that used on an incandescent lamp, having the outer shell and the central terminal button joined by a piece of lead alloy wire, which will melt from the heat if more than a certain amount of current passes over it.

A fuse often blows out when a vacuum cleaner or an electric iron is used after dark, because the lights that are operated on a circuit are consuming current almost to the capacity of the fuse, and when the electric iron or vacuum cleaner is put in circuit, the heavy rate of current flow causes the fuse to blow out. Heavier fuses should always be used in lines where appliances other than lamps are apt to be used in conjunction with them.

The usual form of fuse block is shown at Fig. 56, B, with the fuses in place. The top of the fuse

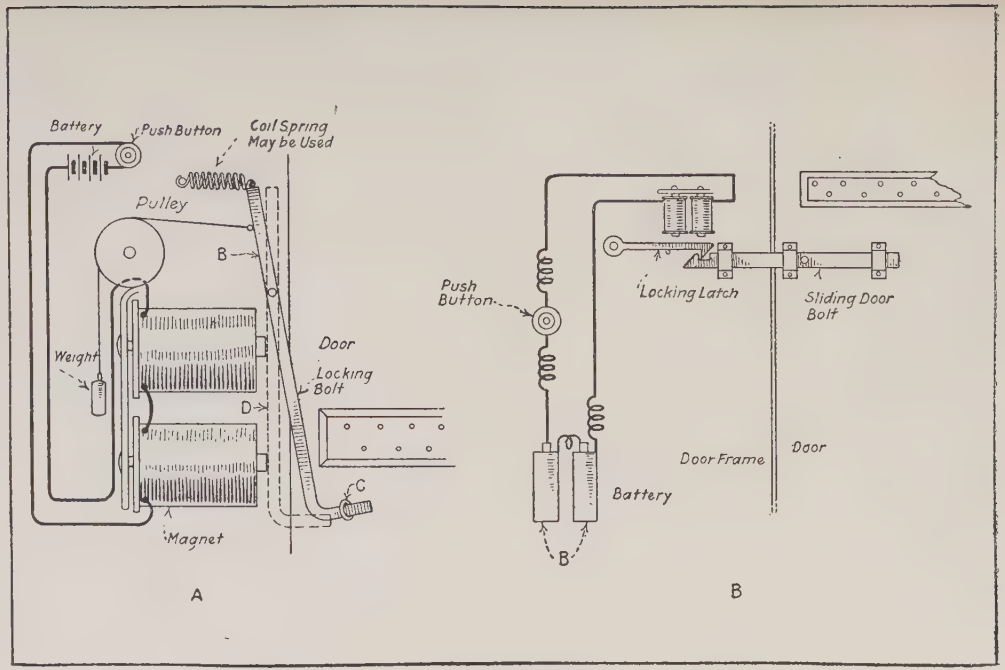

FIG. 55.—ELECTRICALLY OPERATED DOOR LOCKS.

is closed in with a piece of mica or isinglass, and when a fuse is blown this is usually blackened so that the interior cannot be seen, otherwise the fuse-plug shell interior can be inspected and the wire binding the two parts of the block can be easily seen.

The replacing of a fuse is a simple matter, and it is only necessary to unscrew the blown or defective fuse-plug, and screw in a new one in its place. This operation is as simple as removing or installing an electric lamp in a socket. If it is impossible to keep a fuse from "blowing," the trouble is due to a short circuit in the wiring, and it should be corrected by a competent electrician before an attempt is made to use the current. Several replacements should be available at all times, and should be placed near the panel box so as to be accessible in the event of a fuse blowing out on any of the circuits. The ordinary fuse for household use is rated at five ampères, though they may be obtained in varying capacities, depending upon whether they are used for lighting or power circuits, and also according to the voltage of the circuit.

Simple Attachment Plugs.—It is sometimes necessary to attach an appliance to a lighting fixture when no extension plug is available. Various simple methods of doing this are shown at Fig. 57. The emergency extension plug shown at A is made by using a base from an old lamp, the inside of which is cleaned out thoroughly, and one end of a wire attached to the contact button at the centre

of the porcelain insulator at the base, and the other end secured to a terminal post taken from the carbon of an old dry battery. The other wire is attached to the threaded shell at one end, and to a terminal post at the other. The inside of the socket is then filled with plaster of Paris, which is formed up as indicated, by being poured into a mould made by rolling a piece of paper in cylindrical form and inserting it in the socket shell before the mixture is poured in. This paper mould is also very useful in keeping the terminal screws in place until the plaster of Paris sets. The plaster of Paris is mixed with water to form a paste that may be easily poured in the shell and mould interiors.

The attachment plug shown at B is made by drilling a hole in the centre of the fibre casing of a cartridge fuse, into which a socket bushing is tightly screwed. The wires are passed through this, and are attached to the clips to which the fuse wire would ordinarily be attached. The cover is taken off by prying around the brass ring, which gives access to the interior. The method of using this attachment fixture is also clearly outlined, as simple clip fittings may be secured to a block and interposed to the circuit. One of the wires should be attached to one clip, the other circuit wire to the other clip, so that when the plug is put in place it is in parallel with the circuit, and not in series.

A fuse-plug of the screw type may be used for an extension plug by putting a hole in the mica cover

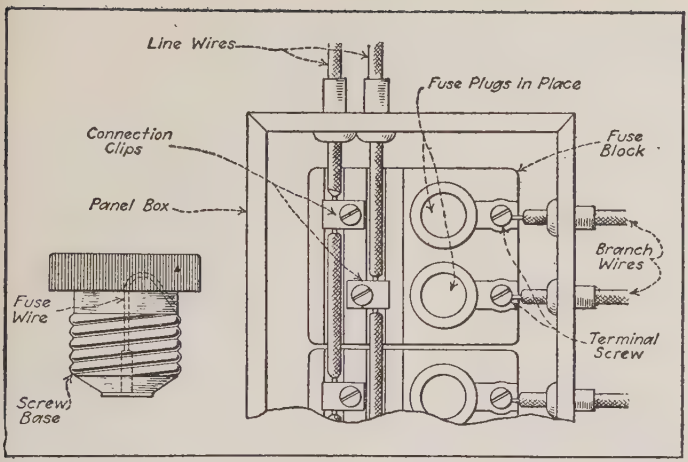

FIG. 56.—TYPICAL FUSE-PLUG AND PANEL BOX IN WHICH IT IS USED.

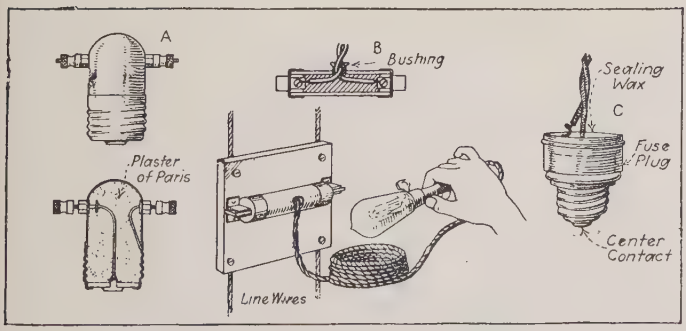

FIG. 57.—A VARIETY OF ATTACHMENT PLUGS THAT CAN BE MADE IN THE HOME WORKSHOP.

that allows joining of one wire to the centre contact at the bottom, and the other wire to the brass shell below the knurled part, taking care to solder both wire ends securely against the metal parts they are joined to. The interior of the fuse-plug is then filled with melted sealing wax or with plaster of Paris, to keep the wires from coming in contact with each other, and also to hold them firmly in place so that they will not come loose.

Controlling One Lamp from Two Points.—The diagram at Fig. 58 shows how one electric light may be turned on and off from two different points. This is especially handy when one wishes to control the light from the top of the cellar stairs, for example, and from the cellar itself. Two point switches are used which are wired in the circuit as outlined. With this arrangement either switch may be used to control the lamp.

Home-made Night Lamp.—A very effective, yet simple, night lamp may be constructed by the home mechanic by following the suggestions at Fig. 59, A. The base piece as well as the upright may be constructed of any desired wood, painted and finished to suit the taste of the builder. To prevent the base from scratching polished furniture, a piece of felt or flannel or any other suitable cloth may be glued to the under-side of the base. The small battery may be the type used as a recharge for a flashlight or may be made up of two small dry cells. The lamp is the ordinary small bulb such as used in a flashlight provided with a

screw base to fit a miniature socket. Ordinary twisted lamp cord is used to make the circuit, this running to a pear-shaped push-button which may be carried to any desired point, or a small one-point switch may be placed on the base instead of the push-button. A simple screw hook serves as a hanger for the watch, the face of which is illuminated by the small lamp when the switch closes the circuit.

The home-made lantern operated from a single dry cell of the No. 6 size, which is $2\frac{1}{2}''$ in diameter and 6″ long, is shown at Fig. 59, B. A small funnel serves as a reflector, the spout of the funnel being removed. The funnel is attached to the carbon terminal by means of a piece of bent metal soldered to the funnel at one end, and having a hole in the other to fit over the carbon terminal screw. The lamp is the type such as used in an automobile side-light, and is attached to the funnel by a sheet metal clip.

The switch is made by using a piece of spring brass which is attached to a fibre strip at one end, and so shaped as to be brought in contact with the zinc terminal of the battery at the other. The socket of the lamp acts as one terminal by being attached to the funnel, while the centre contact is connected to the fibre piece by a short wire as indicated. A suitable clamp and handle by which the cell may be carried is bent up of light sheet metal. The method of construction is clearly shown in the details accompanying the sketch.

Drop Light Adjusters.—A simple method of

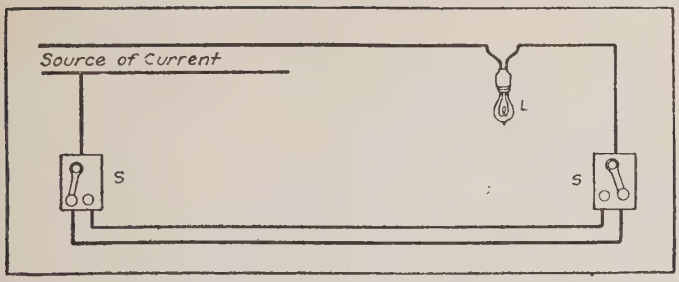

FIG. 58.—TURNING ON ONE LAMP FROM TWO POINTS.

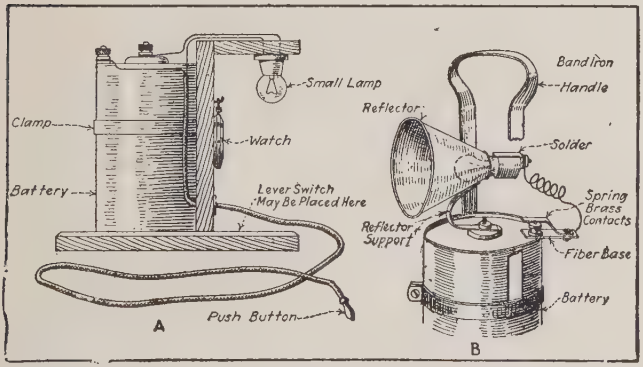

FIG. 59.—A HOME MADE NIGHT LAMP AT A, AND A SIMPLE LANTERN AT B.

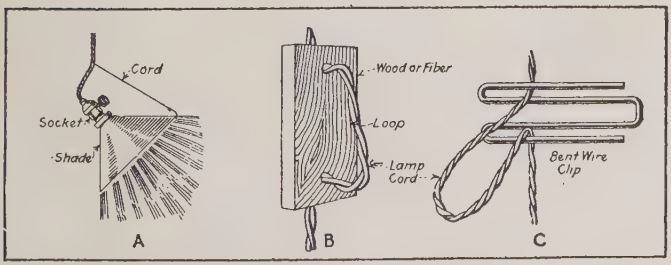

FIG. 60.—SIMPLE LAMP CORD ADJUSTERS OF WOOD AND WIRE.

making an angle drop light is shown at Fig. 60, A. An ordinary piece of cord is tied to a hook, which may be made of any desired piece of wire, such as a paper clip or a piece of hairpin. The other end of the cord is tied to the lamp cord and, when the hook is looped over the shade, the lamp will be tilted to any angle desired by varying the length of the string. The shade may be inclined so that the light may be directed to any point desired.

Two simple drop light adjusters are also shown at Fig. 60. That at B is made from a piece of wood $\frac{3}{8}''$ thick, $1\frac{1}{2}''$ wide, and $3''$ long. A $\frac{1}{4}''$ hole is bored through about $\frac{1}{2}''$ from each end. The length of the lamp cord may be varied by increasing the size of the loop as desired. A $\frac{1}{4}''$ hole is the proper size to use with an ordinary lamp cord, though it is evident that the holes may be made to any size to accommodate the diameter of the lamp wires. The adjuster shown at Fig. 60, C, consists of a piece of copper or iron wire about $\frac{1}{8}''$ in diameter bent up as indicated. The method of using it is clearly shown in the illustration.

CHAPTER V

HELPFUL RECIPES AND FORMULÆ

Cleaning Waste-pipes—A Superior Whitewash—Silvering Metals—Writing on Steel—Black Lacquer for Metal or Wood—A Good Polish for Brass—Filling for Cracked Ceilings—Filling Cracks in Floors—Fastening an Umbrella Handle—To Frost Glass—To Brighten Silver-plated Articles—To Remove Rust From Steel—Cleaning Marble—Cleaning Paint—Removing Hard Wax and Candle Grease from Cloth—To Remove Soft Grease Spots from Fabrics—Preparation for Cleaning Gloves—Eradicating Ink Stains—Miscellaneous Cements and Adhesives—Marine Glue—Glue to Resist Damp—Rubber Cement—Cement to Mend Crockery—Cements for Pipe Joints—Cement for Iron—Paste for Sticking Paper Labels to Glass, Wood, or Metals—Adhesive Material—Alum and Plaster of Paris Cement—Indestructible Writing Ink—Removing Ink Stains from Wood—Preserving Leather—Oiled Dust-cloth—Detection of Gas Leaks—How to Read a Gas-meter—Cleaning Stove-pipes—Varnish for Stove-pipes—French Polish Revivers—Paints for Boiler Fronts.

The handy man is expected to be a compendium of useful information, and if he is known to be mechanically inclined, he is the adviser, not only in his own household, but in those of his friends who do not have such ability. He is asked numerous questions, some of which concern mechanical processes, others which deal with various recipes for doing anything, from removing grease spots to painting a stove-pipe or boiler front with a paint

that will not burn off. The collection of recipes and formulæ which follow have been secured from *Henley's Twentieth-century Recipe Book*, for the most part, and are believed to contain considerable information that will be of value to the handy man, because they give suggestions that can be applied to advantage around the home.

Cleaning Waste-pipes.—One of the frequent annoyances of housekeeping is the obstruction to the free, quick outlet of the waste water of the washstand, the bath-tub, and the kitchen sink. This results from a gradual accumulation of small bits of fatty material, paper, lint, meat, bones, or other offal which check and finally entirely stop the outflow of the waste water. The plumber is called, and usually removes the stoppage with his force-pump. Sometimes this is effective ; at others the offending waste-pipe is cut out, and a new one put in its place at considerable cost.

A simple, inexpensive method of clearing the pipe is as follows: Just before retiring at night pour into the pipe enough *liquid* potash (not soda) lye of 36° strength to fill the " trap," as it is called, or bent portion of the pipe just below the outlet. About a pint will suffice for a washstand, or a quart for a bath-tub or kitchen sink. Be sure that no water runs into it till next morning. During the night the lye will change all of the offal in the pipe into *soft soap*, and the first current of water in the morning will remove it entirely, and leave the pipe as clean as new. Two applications of the

lye should be enough to cure any case. The so-called potash lye sold in small tin cans in the shop is not recommended for this purpose; it is quite commonly misnamed, and is called caustic *soda*, which makes a hard soap. That may block up the pipe even worse than the material it was desired to remove.

A Superior Whitewash.—For a useful limewash for wood and stone, the following method of preparation is given by an expert. Twenty quarts of quicklime are slaked in a suitable vessel with as much hot water as will stand at a level of 6 inches above the lime. The milk of lime is diluted, and first 15 grains of sulphate of zinc and then 7 grains of common salt are added. The latter causes the limewash to harden without cracking. A beautiful cream colour can be imparted to the mass by putting into it 7 grains of yellow ochre, or a pearly tint by addition of some lampblack. A fawn colour is produced by 2 grammes of umber and 7 grains of lampblack. A stone colour can be obtained from 30 grains of umber and 7 grains of lampblack. The colour is applied, as usual, with a large flat brush.

Silvering Metals.—Small articles may easily be coated with silver by dipping them first into a solution of common salt, and rubbing with a mixture of 1 part of precipitated chloride of silver, 2 parts of potassa alum, 8 parts of common salt, and the same quantity of cream of tartar. The article is then washed and dried with a soft rag.

Writing on Steel.—Steel can be written on or engraved for marking tools by first cleaning it with oil and then spreading a coating of melted beeswax upon it. The writing can then be done on the beeswax with any sharp instrument, and the lines and marks thus made should be painted with a fine brush dipped in a liquid made of one ounce of nitric acid and one-sixth of an ounce of muriatic acid. When the written lines are filled with this liquid, it should be allowed to remain five minutes, and then the article should be dipped in water and wax removed and steel cleaned.

Black Lacquer for Metal or Wood.—Nine parts of shellac are dissolved in 50 parts of methylic alcohol and set aside for a few days. Then 10 parts of pulverized asphaltum are dissolved in 50 parts of coal-tar benzine. Both liquids being mixed, a sufficient quantity of lampblack is added to give it the required density. When necessary, it may be diluted with a mixture of alcohol and benzine.

A Good Polish for Brass.—For polishing bright brasswork, rub the surface of the metal with rottenstone and sweet oil, and then rub off with a piece of cotton flannel and polish with soft leather. A solution of oxalic acid rubbed over tarnished brass soon removes the tarnish, rendering the metal bright. The acid must be washed off with water, and the brass rubbed with whiting and soft leather. A mixture of muriatic acid and alum dissolved in water imparts a golden colour to brass articles that are steeped in it for a few seconds.

Filling for Cracked Ceilings.—Whiting mixed with glue-water or calcined plaster and water makes a good putty for filling cracks in plastered ceilings or walls. The filling material is in the form of a paste, and is worked into the crack with a putty knife.

Filling Cracks in Floors.—Cracks in floors can be neatly and permanently filled with a paste made by soaking newspapers, ½ lb. of flour, 3 qts. of water, and ½ lb. of alum thoroughly mixed and boiled. The mixture acquires the consistency of putty, and when forced into the cracks of the floor it will harden similar to *papier mâché*, and will resist wear as well as wood and prevent dirt getting into the cracks.

Fastening an Umbrella Handle.—Sometimes a person would like to change a good umbrella handle from a discarded one to another umbrella and fasten it on solidly. This is done by cleaning out the hole left in the handle from the old rod, and then filling the hole with flour of sulphur. Place the handle firmly in an upright position. The umbrella rod is heated red hot and pushed down into the hole containing the sulphur. The heat fuses the sulphur, and when cold it will hold the rod solidly. This method may be applied to fastening rods into stone, iron, or wood, and also for holding knives and forks into bone or other similar handles.

To Frost Glass.—The following process can be used for lights of glass already set in the sash. Dissolve 1 part of wax in 10 parts of oil of turpentine, and add 1 part each of varnish and siccative.

With this mixture the panes are coated on the outside, and before drying dabbed with a pad of cotton wadding. If desired, small quantities of Paris blue, madder lake, etc., may be mixed with the wax solution, which will make the frosting a corresponding colour. This is a good method of frosting lamp bulbs.

To Brighten Silver-plated Articles.—Articles of silver and silver-plated ware rapidly tarnish when kept in rooms where gas is used for illuminating purposes, and anywhere in manufacturing cities, where the air is constantly filled with sulphurous vapour. This may be avoided by dipping the articles occasionally in a solution of hyposulphite of soda. Large articles, like jugs and salvers, should be wiped off with a rag dipped in the solution, and dried with a soft towel. A rub with a bit of chamois leather makes them as brilliant as new.

To Remove Rust from Steel.—Place the article in a bowl containing kerosene oil, or wrap the steel up in a soft cloth well saturated with kerosene; let it remain 24 hours or longer; then scour the rusty spots with brickdust. If badly rusted, use salt wet with hot vinegar; after scouring, rinse every particle of brickdust or salt off with boiling hot water; dry thoroughly; then polish off with a clean flannel cloth and a little sweet oil or "3 in 1" oil.

Cleaning Marble.—A paste formed of whiting and benzine will cleanse marble from grease, and one made of whiting and chloride of soda, spread and

left to dry, in the sun if possible, on the marble will remove stains.

Cleaning Paint.—(1) To clean paint, take 1 oz. powdered borax, 1 lb. small pieces best yellow laundry soap, and 3 qts. water; simmer till the soap is dissolved, stirring frequently, and take care not to have the mixture come to a boil. Use with a piece of old flannel, and rinse off as soon as the paint is clean. This mixture is good for washing clothes.

(2) Take a pail of hot water; throw in 2 tablespoonfuls of powdered borax; use a good coarse towel and wash the painting; do not use a brush; when washing places that are extra yellow and stained, soap the cloth; then sprinkle it with the dry powdered borax, and rub the places well, using plenty of rinsing water. In washing the woodwork in this way, the paint will not be injured, and the borax will soften and make the hands white—a fact well worth knowing.

Removing Hard Wax and Candle Grease from Cloth.—Rub and scrape off as much of the wax as possible; hold a hot poker or a burning match as near the cloth or fabric as possible, without igniting it, and the wax will melt and sink into the fabric and disappear. This does not really remove it. A far better way is to place a piece of good blotting-paper over the stain and press it with a hot iron, shifting the blotting-paper two or three times if the spot is large. The wax melts and a large proportion is absorbed by the blotting-paper.

To Remove Soft Grease Spots from Fabrics.—Sponging with benzine, ether, or chloroform is generally recommended, and, as usually effected, ends in the production of a ring-shaped stain. To avoid this proceed as follows: Moisten the cloth all around the stain with the benzine or other solvent, making a complete ring, and giving it all the liquid it will take up. Now work inwards towards the stain, and eventually sponge it off, and if desired apply dry blotting-paper to remove the surplus. A sponge should be used, as it acts in a double capacity, applying the solvent when squeezed, and reabsorbing it and the grease with it when relaxed. An excellent way of applying the ring of liquid is to use a piece of blotting-paper, circular, and perforated with a hole slightly larger than the spot of grease. This is laid upon the cloth and the solvent is poured upon it.

Preparations for Cleaning Gloves.—Six parts of soap are dissolved in 2 parts of water; 4 parts of Javelle water and $\frac{1}{4}$ part of aqua ammonia are added. The glove is sponged off with this liquid. As a simpler application, the gloves while on the hand may be rubbed with bread crumbs or india-rubber sponge eraser as used by draftsmen for cleaning drawings.

Eradicating Ink Stains.—Pyrophosphate of soda is recommended for the removal of ink stains. This salt does not injure vegetable fibre, and yields colourless compounds with the ferric oxide of the ink. It is best to first apply tallow to the ink spot,

then wash in a solution of pyrophosphate until both tallow and ink have disappeared.

Miscellaneous Cements and Adhesives, Marine Glue.—(1) Caoutchouc, 1 oz. ; genuine asphaltum, 2 oz. ; benzole or naphtha, q. s. The caoutchouc is dissolved by digestion and occasional agitation, and the asphaltum is gradually added. The solution should have about the consistency of thick syrup.

(2) Dissolve 1 part of indiarubber in 12 parts of benzole, and to the solution add 20 parts of powdered shellac, heating the mixture cautiously over a fire. Apply with a brush.

Rubber Cement.—Digest caoutchouc, cut in fine shreds, with about 4 volumes of naphtha in a well-covered vessel for several days. Naphtha should not be used indoors. Keep the cement in a tightly corked bottle to avoid evaporation of the volatile solvent.

Glue to Resist Damp.—A glue to resist damp can be prepared with boiled linseed oil and ordinary glue ; or by melting 1 lb. of glue in 2 qts. of skimmed milk and adding shellac, 4 oz. ; borax, 1 oz. boiled in a little water, and concentrated by heat to form a paste.

Cement to Mend Crockery.—One of the strongest cements, and easily applied for this purpose, is lime and the white of an egg. To use it, take a sufficient quantity of the egg to mend one article at a time, shave off a quantity of lime, and mix thoroughly. Apply quickly to the edges and place

firmly together, when it will very soon become set and strong. Mix but a small quantity at once, as it hardens very soon, so that it cannot be used. Calcined plaster of Paris would answer the same purpose as lime.

Cements for Pipe Joints.—The following are cements for steam and water joints: (1) Ground litharge, 10 lb.; plaster of Paris, 4 lb.; yellow ochre, ½ lb.; red lead, 2 lb.; hemp, cut into ½-inch lengths, ½ oz.; mixed with boiled linseed oil to the consistency of putty.

(2) White lead, 10 parts; black oxide of manganese, 3; litharge, 1; mixed boiled linseed oil.

A cement for joints to resist great heat is made thus: Asbestos powder, made into a thick paste with liquid silicate of soda.

Cement for Iron.—The following cement is recommended for repairing damaged places in iron castings: 5 parts brimstone, 2 parts black lead, and 2 parts cast-iron filings (previously sifted) are melted together, taking care that the brimstone does not catch fire. The damaged place should be perfectly dry, and well heated by laying a piece of red-hot iron upon it, and is then stopped with the cement, previously heated in a melting-ladle till it becomes soft.

Paste for Sticking Paper Labels to Glass, Wood, and Metals.—The mixture is composed of starch, 2 dr.; white sugar, 1 oz.; gum arabic, 2 dr.; water as required. Dissolve the gum, add the sugar, and boil until the starch is cooked.

Adhesive Material.—This is made of water, 1 oz.; methylated spirit, 2 oz.; dextrine, 2 tablespoonfuls. Mix the water and spirit; stir in the dextrine to produce a smooth paste, and place the vessel, in which the ingredients have been mixed, in hot water till a clear brown solution results.

Alum and Plaster of Paris Cement.—Alum and plaster of Paris, mixed with water and used in liquid state, form a hard composition and a useful cement for filling cracks in plaster, china, etc.

Indestructible Writing Ink.—It is said that an ink that cannot be erased even with acids is obtained by following this recipe: A strong solution of fine soluble Prussian blue in distilled water is added to good gall ink. This addition makes the ink, which was previously proof against alkalies, equally proof against acids, and forms a writing fluid which cannot be erased without destruction of the paper. The ink writes greenish blue, but afterward turns black.

Removing Ink Stains from Wood.—Mix carefully 8 oz. concentrated sulphuric acid and $1\frac{3}{4}$ pints of water, and allow it to stand until cool, taking care to pour the acid slowly into the water, stirring meanwhile. Scour the stain with water and sand thoroughly, and then pour some of the mixture upon it and rub until the stain has disappeared.

Preserving Leather.—(1) Equal parts of mutton fat and linseed oil mixed with one-tenth their weight of

Venice turpentine, and melted together in an earthen pipkin, will produce a "dubbin" which is very efficacious in preserving leather when exposed to wet or snow, etc. It should be applied when the leather is quite dry and warm. (2) Many other formulæ exist for dubbins, but all contain essentially the same ingredients. (3) A solution of 1 oz. solid paraffin in 1 pint light naphtha, to which 6 drops sweet oil have been added, is put cold on the soles, until they will absorb no more. One dressing will do for the uppers. This process vastly increases the tensile strength of every stitch; and, while not removing the natural moisture of the leather, decidedly waterproofs the boot. The sole lasts two months longer when so treated. (4) There is nothing like castor-oil for preserving leather. Applied once a month, or twice or once a week in snowy weather, it not only keeps the leather soft, but makes it waterproof. Copal varnish is the best thing to apply to the soles, but the latter should be thoroughly dry and, if they have been worn, they should be previously roughed on the surface before applying the varnish.

Oiled Dust-cloth.—Saturate a suitable piece of cloth with kerosene, and lay it aside until the surplus oil has evaporated. Rub it on a wooden surface until it no longer leaves a streak, and it is ready for use. This cloth should be well shaken after each use, and re-oiled about once a month. Another method is to mix 30 parts of kerosene with 10 parts of double refined rapeseed soil, heat moder-

ately, and stir into it 1 part of melted benzine. Immerse the cloths in this liquid until they become entirely saturated with it; wring out well, and dry in a shady place. The cloths do not injure even polished furniture, but rather enhance the brilliancy.

Detector of Gas Leaks.—By far the best test is

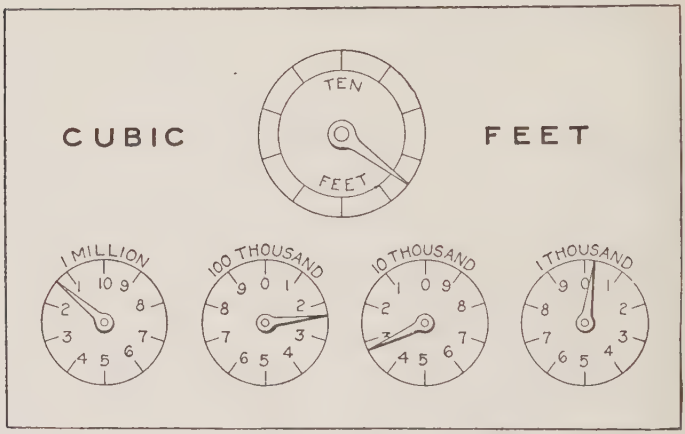

FIG. 61.—DIALS OF TYPICAL GAS-METER SHOWING METHOD OF READING AS DESCRIBED IN TEXT.

to rub a little soapy water upon the suspected place. The formation of a bubble will show where the leak is. Never look for a gas leak with a naked flame, and just as soon as a leak is detected, open the windows of the room to insure adequate ventilation until the leak is found.

How to Read a Meter.—The dial marked "1 thousand" in the accompanying illustration, Fig. 61, is divided into hundreds; the dial marked

"10 thousand" is divided into thousands; that marked "100 thousand" into ten-thousands, and that marked "1 million" into hundred-thousands. When 1,000 cubic feet of gas have been consumed, the pointer on the dial marked "1 thousand" will have made a complete rotation, and the fact will be indicated by the pointer of the next dial at the left, which will point to the figure 1. When 10,000 cubic feet of gas have been consumed, the pointer on the "10 thousand" dial will point to 1, and so on. In reading a gas-meter, put down the hundreds first, then the thousands, and so on, always counting the figure just under or which has just been passed by the pointer. In the illustration about half a hundred is indicated on the "1 thousand" dial, three thousand is indicated on the next dial, and one hundred thousand on the "1 million" dial. The reading will be 123,050. The dial marked "ten feet" is called the units dial. It is used for testing the meter to discover whether it is in working order or not. Each mark represents a cubic foot, and the complete circle 10 cubic feet. If the pointer moves when no gas is burning, it indicates a leak. If it does not move when the gas is burning, or if its motion is unsteady, it indicates a derangement in the mechanism, and shows that the meter requires attention.

Stove-pipes.—The fumes from a piece of zinc put on the live coals in the stove will clean out the stove-pipe. A stove-pipe may be protected by using a varnish composed of asphaltum, 2 lb.;

boiled linseed oil, 1 pt.; oil of turpentine, 2 qts. Melt the asphaltum in an iron pot, boil the linseed oil and add to the asphaltum while hot. Stir well and remove from the fire. When partially cooled, add the oil of turpentine.

French Polish Reviver.—Linseed oil, ½ pt.; spirits of camphor, 1 oz.; vinegar, 2 oz.; butter of antimony, ½ oz.; spirit of hartshorn, ¼ oz. Mix together and apply with a cloth. Another mixture recommended is naphtha, 1 lb.; shellac, 4 oz.; oxalic acid, ¼ oz. Still another is made as follows: ½ gill of vinegar, 1 gill spirits of wine, 1 dr. linseed oil. Let stand till dissolved, then add 3 oz. linseed oil. Apply with a piece of cheese-cloth and rub to a polish.

Paint for Boilers.—Use asphaltum varnish to paint the metal-work. There is little or no odour from it when dry. Another mixture is made of coal-tar and ground graphite thinned with turpentine, which forms an excellent paint for boiler fronts and pipes in the boiler-room. The steam-pipe for heating should not be painted or, if required, should only have a very thin coat of lampblack and linseed oil. Rub the boiler front over with a mixture of boiled oil and lampblack. The grease should be taken from the latter before mixing by placing it in a flower-pot, the top and bottom sealed with clay, and subjected to a good heat.

White Paint for Metallic Surfaces.—Oil paints used on metallic surfaces such as radiators, register

facings, etc., exposed to heat frequently turn yellow. If, instead of oil, sodium silicate be used, no change of colour will be noticed. Zinc white mixed with soluble glass of from 40° to 50° B., to the consistency of ordinary paint, makes an excellent paint for metal.

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